PRICE 35 CENTS

NOVEMBER 1954

Welding Engineer

NEW

developments of the welding year

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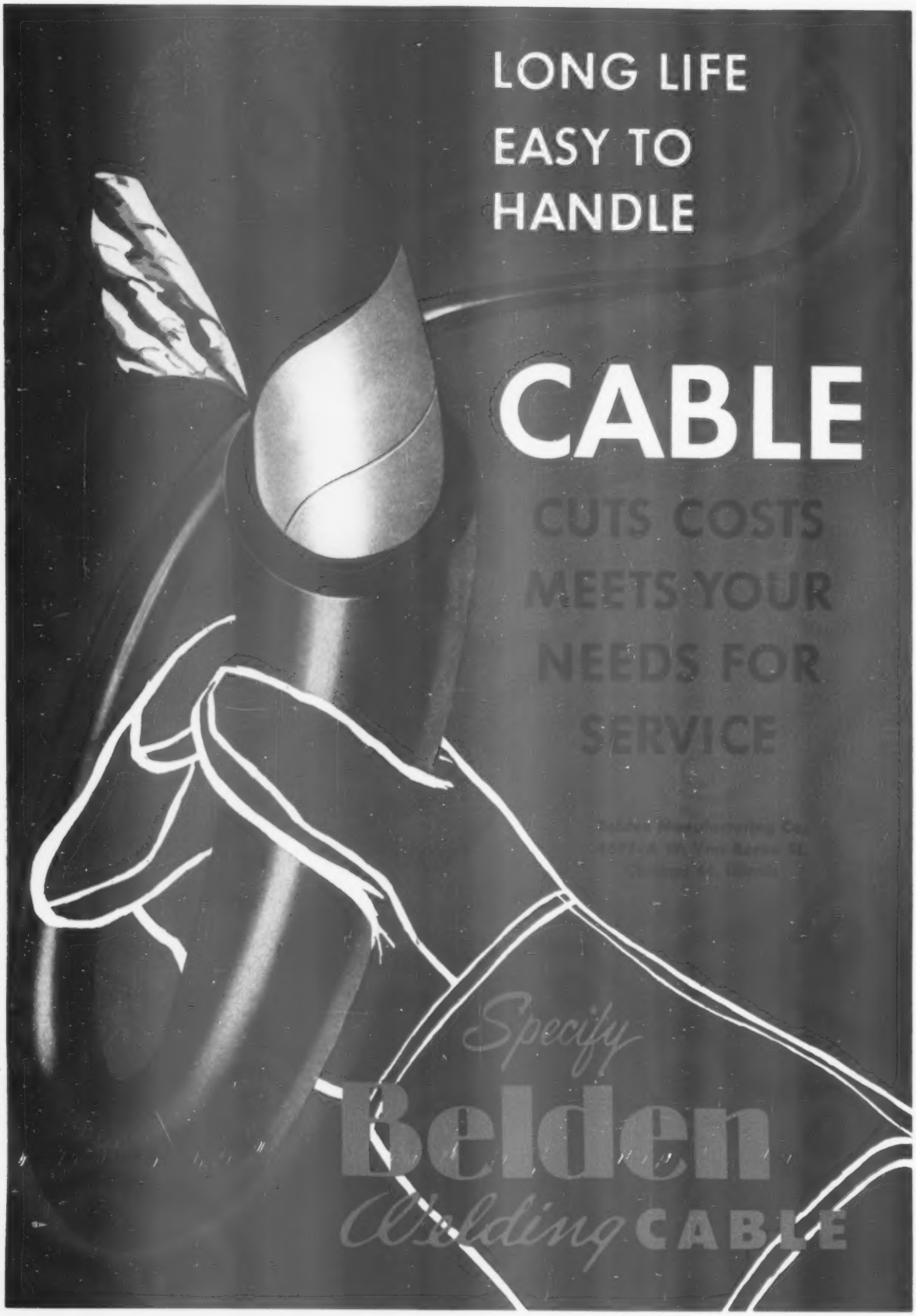
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In addition to the Hobart Line of rotating Type Arc Welders, powered by electric motors and gasoline engines,

This New HOBART Transformer Welder is now available

It embodies Hobart's new "saturable leakage path" design (patent applied for) that assures you higher quality welding, lower welding costs, and improved weld quality.

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Here's a great rod for A.C. work.

Rocket 24

Ask your dealer!

Here's an electrode that has greater strength, speed, smoothness and more maneuverability. It's a mild steel general purpose rod for DC or AC welding. The Rocket 24 is a contact type electrode, heavily coated, employing iron powder in the coating which becomes an additional source of metal for the weld. It forms a flat, finely rippled bead with a minimum of undercut. Check coupon for complete details on this revolutionary new electrode.

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VOLUME 39 NUMBER 11

Welding Engineer

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Jackson SAFETY HATS and CAPS — Cap-and-Helmet Combinations

For protection against falling objects and other sudden impact, and against bumping the head in close quarters, the new Jackson Safety Hats are a *safe* and *sound* investment.

Made of fiber glass plastic, the strongest protective material per ounce of weight, these safety hats surpass all known industrial requirements. They comply with Federal Specifications GGG-H-142b when tested for *electrical resistance*, *impact* (the 8-lb. ball test), *penetration* (the 1-lb. plumb bob test), *flammability*, and *water absorption*. At 14 ounces, *weight* is well below the specified limit.

Two types are available: the full-rimmed *Hat* and the *Cap*, with visor only. Unless otherwise specified, they will be furnished in an attractive, bluish grey.

ALSO FOUR OTHER STANDARD COLORS . . . White, Yellow, Green and Brown

Arc Weldors are offered the choice of the two already popular fiber glass arc-welding helmets, types H-1 and H-2, pivoted to the sides of the Safety Cap. Helmet goes easy *on*, easy *off*. Just slide it in to assemble, push the button to release. Your present helmet, H-1 or H-2, may be utilized by ordering Safety Cap plus Helmet Attachments.

EXCLUSIVE . . . Headband of Extruded Plastic, Cork-Lined Sweatband

Plastic Headband allows immediate, positive adjustment, is clearly marked in hat sizes, holds its shape, and gives firm fit on all sizes of heads.

Straps of webbing button to inside of hat shell, and provide adjustable support on top of the head. They provide the required safe distance between top of head and hat shell and leave ample room for ventilation all around.

JACKSON SAFETY HAT TYPE SH-1

Strongly ribbed crown design and full brim resist impact from all sides. Fiber glass plastic gives the greatest protection per ounce of weight.

JACKSON SAFETY CAP TYPE SC-1

Identical with the Safety Hat but with only a narrow brim at sides and back, and a visor protecting the face. Weight 12¼ ounces.

JACKSON CAP-AND-HELMET TYPE SCH-1

Arc-Welding Helmet, type H-1, pivoted to standard grey Safety Cap. Both are fiber glass of matching design and color. Visor is worn in back.

JACKSON CAP-AND-HELMET TYPE SCH-2

Lift-Front Helmet, type H-2, permitting work inspection without raising of entire helmet, pivoted to Safety Cap. Units are detachable without tools.

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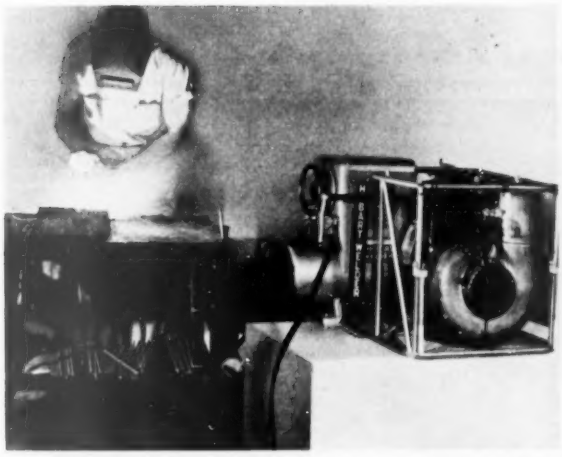


EXPERIMENTAL arc welder is first to use gas turbine

WELDING ENGINEER is read at Mexico welding clinic

NEWS

Gas turbine used as prime mover in arc welder

PICTURED above is what is said to be the first arc welder to use a gas turbine as a prime mover. It is shown with a 250-amp capacity, d-c welding generator. A development of Hobart Brothers Co., Troy, Ohio, it is not a commercial venture, but rather an experimental one.

In building this special unit that was successfully operated and tested under actual working conditions, the company is primarily interested in knowing more about the gas turbine and the possibilities it might hold for use in building more compact and lighter weight equipment.

* * *

Tulsa man wins Lincoln award

WILLIAM W. Ansteth, employed by Thomas Landscape and Nursery Co., of Tulsa, has been awarded the $1,000 first award in a national arc-welding competition sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland.

The award was one of 191 made to persons in non-industrial business and service establishments who submitted papers describing how welding is or could be used in the operation or maintenance of the business or service. Mr. Ansteth described numerous applications of arc welding in the nursery business, showing how economies could be or were effected.

Awards totaling $13,500, including five second awards of $500 each, were distributed in 43 states, Alaska and Hawaii.

* * *

NWSA West Central zone meeting this month

THE West Central zone meeting of National Welding Supply Association will be held Nov. 15 and 16 in the Hotel Fontenelle, Omaha.

* * *

Claim economic welding of mild steel by Mig method

JUST as this issue of WELDING ENGINEER went to press, an announcement was made by Westinghouse Electric Corp. that its engineers have improved the Mig (metal inert-gas) welding process whereby it can now be used to weld mild steel economically.

Key to the new process, according to W. J. Delaney, Jr., manager of the Arc Welding Dept., Buffalo, is a new coated wire called "West-ing-arc MS-20." Other new components of the new welding system include the gun. feed-wire control and a d-c arc welder.

Westinghouse claims that mild steel —with or without normal mill scale— of thickness from 1/16 in. up can be fillet, lap or butt welded. The system can be used automatically or semiautomatically.

Further details on the improved process and what Westinghouse claims it can do will be published in next month's WELDING ENGINEER.

Three-day welding clinic first to be held in Mexico

LATEST technical developments in welding were demonstrated at a three-day clinic recently held in Mexico City by Soldaduras y Equipos de Mexico, S. A. It was reported to be the first such clinic held in Mexico, and it drew a large attendance.

In addition to demonstrations of the newest in welding, the clinic offered technical movies and exhibits explaining inspection of welds by X-ray analysis.

Present among representatives of private industry from the United States were T. P. Champion, president of The Champion Rivet Co., Cleveland; Lorn M. Campbell, president of Harris Calorific Co., Cleveland; and Walter W. Offner, president of X-Ray Engineering Co., San Francisco.

—McGraw-Hill World News

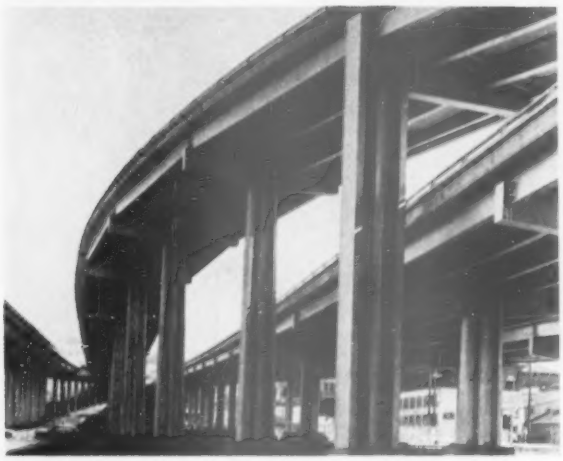
* * *

Baltimore man takes honors in Pandjiris contest

"QUANTITY Accompanies Quality in Positioned Welds" was the title of the entry adjudged top honors in the positioned-welding essay contest sponsored by Pandjiris Weldment Co., St. Louis. First prize of $500 was awarded to its author, W. B. Wood, of Baltimore.

An international flavor was added to the contest by the second-prize winner, G. Gordon Musted, of Warwickshire, England, who received $250. Third prize—$150—went to Roy W. Dryer, Wallington, N. J.; fourth prize of $50 was awarded Robert C. Smith, Pickstown, S. D.; fifth prize, also $50, was won by A. R. Mellini, Cleveland.

Pandjiris has announced it expects to conduct another essay contest in 1955.



BEAUTIFUL-bridge award went to all-welded structure

DISTRIBUTOR held welding show indoors and outdoors

All-welded bridge wins AISC award

AN all-welded bridge has won top honors in one class of the American Institute of Steel Construction's 26th annual aesthetic bridge competition. Selected as the most beautiful of bridges with spans under 400 ft and costing over $500,000 (Class II) was the Ninth & Tenth St. connections, Bayshore Freeway, San Francisco.

Designed by the California state bridge department and built by Bethlehem Pacific Coast Steel Corp., the bridge (pictured above) was acclaimed by the jury not only as a winner but as "the most imaginative entry, because it is an honest structural solution to a difficult and complex problem . . . there is great harmony in the structure even though both single and double columns are used in the supports."

Another winner, in Class III (for bridges with fixed spans under 400 ft and costing less than $500,000), has welded built-up girders. This prize-winner is the Robert St. underpass for pedestrians, South Freeway, Fort Worth.

The annual beautiful-bridge competition is restricted to steel bridges opened to traffic during the previous year.

* * *

Oakite research men in scientists' paradise

GREATLY expanded chemical and engineering laboratories of Oakite Products, Inc., at 350 Hudson St., New York City, will enable extensive research to be carried on in problems of metal cleaning, including the cleaning of aluminum in preparation for resistance welding.

The new quarters for Oakite engineers and chemists cover 30,000 sq ft of floor space, cost around $500,000 for equipment and provide everything needed to make a scientists' paradise. There are separate laboratories for research in inorganic cleaning materials, bacteriology, transportation and petroleum industries, analytical chemistry, conversion coatings, solvents and detergents, microscopy and crystallography, paint stripping, and electrocleaning, as well as a comprehensive engineering testing section.

Under way but not yet completed is a 54 ft by 66 ft pilot plant in which small-scale manufacture of new cleaning compounds can be carried on in advance of field tests.

* * *

Naval architects meet this month in New York

THE 62nd annual meeting of The Society of Naval Architects and Marine Engineers will be held Nov. 10-13 at the Waldorf-Astoria in New York City.

* * *

Polymer Industries to make Eutectic's adhesives

METAL-bonding adhesives formerly manufactured by the ChemoTec Division of Eutectic Welding Alloys Corp., Flushing, N. Y., will be manufactured, sold and serviced by the Adhesive Division, Polymer Industries, Inc., Viaduct Road, Springdale, Conn., according to a recent announcement.

Virginia Welding Supply conducts welding show

MORE than 900 persons attended a three-day (Sept. 7-9) welding show conducted by Virginia Welding Supply Co., Charleston, W. Va. Among the many features were live demonstrations of pipe beveling, wrinkle bending, hand cutting, machine cutting, stainless-steel welding, multiflame heads and various welding processes.

The show was held inside the firm's warehouse and under tents and lights outside in the parking lot. Seven films were shown in the "basement theatre." In addition to other distributor firms, the following manufacturing companies were represented: Linde Air Products Co., Hobart Brothers Co., Alloy Rods Co., Bay State Abrasive Products Co., Worthington Corp., Stulz-Sickles Co., Jackson Products, Inc., Sellstrom Mfg. Co., Black & Decker Mfg. Co. and United Wire & Supply Corp.

* * *

Two NWSA zone meetings termed "outstanding"

TWO September zone meetings of the National Welding Supply Association were "outstanding" successes, according to reports of those in attendance.

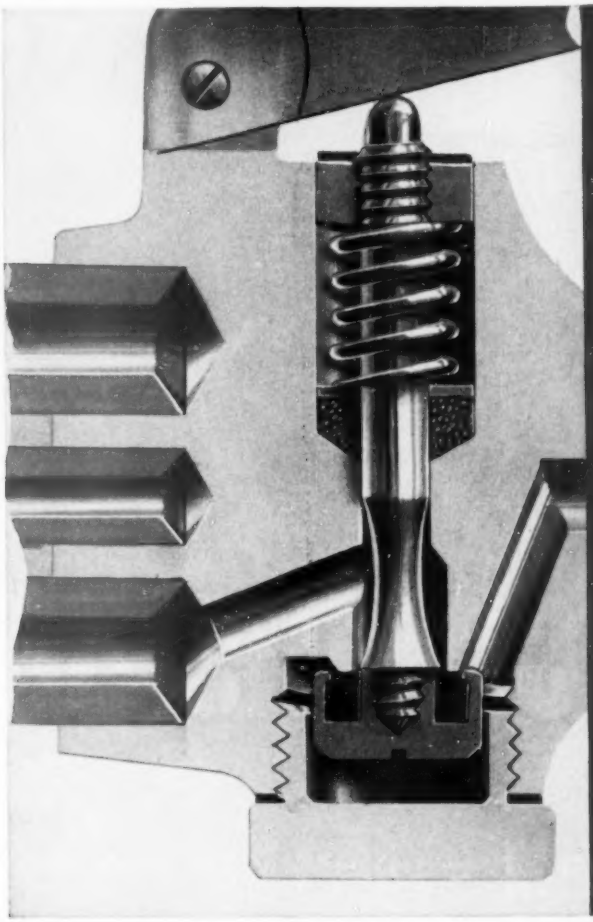
The Eastern zone meeting, held Sept. 20-21 in Boston, was attended by 159 distributors and manufacturers. Two lively panel discussions highlighted the meeting at the Sheraton-Plaza Hotel, which was conducted by NWSA Vice-President Robert G. Jackson, of Jackson Welding Supply Co., Inc., Rochester.

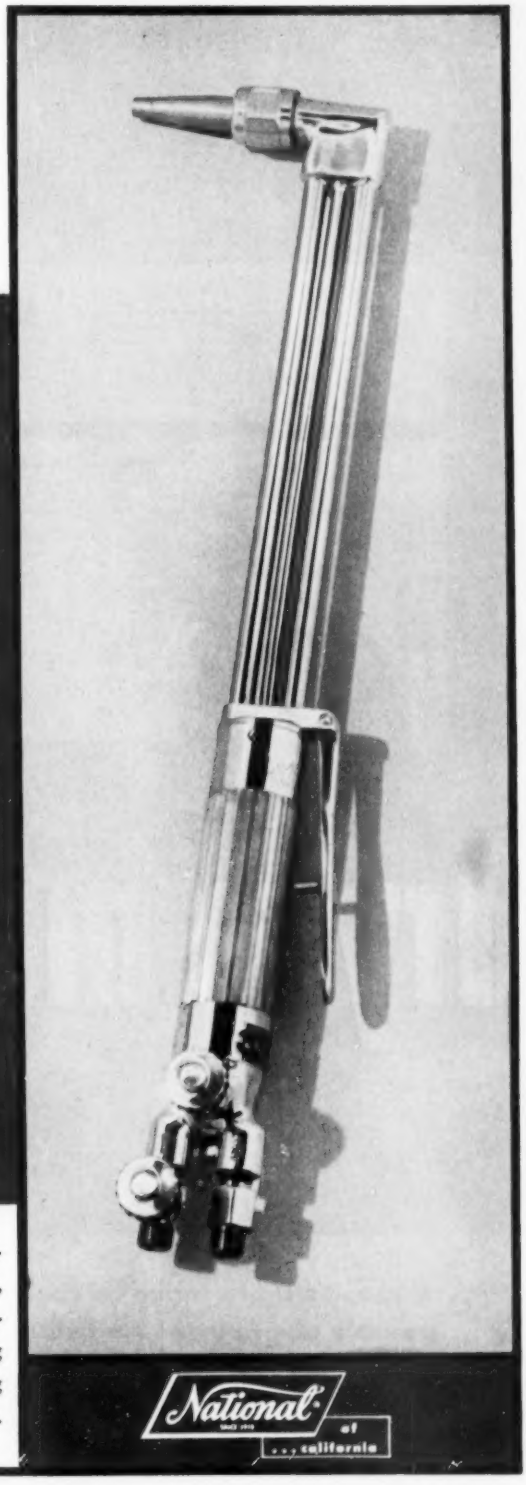
Effective sales training as a manu-

(Continued on page 86)

details count...

look, here is another outstanding reason why you and your operator will be mighty well pleased with the swift, responsive action of this splendid hand cutting torch. Write for 40 page, four color, cutting torch brochure . . . it tells everything.





please note that no packing nut clutters up this leak free, unobstructed, high pressure oxygen valve. Constantly self-sealing, with an easily reachable and renewable seat, its large gas passages provide maximum flow capacity to eliminate preheating flame surge at the critical moment of cutting. No other cutting torch offers you so many outstandingly desirable advantages.

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541 DEPT. 143

Typical Fillet Speeds

Electrode Size	Amps., AC	Fillet Size	Speed, in./min.
3/16"	290	1/4"	15
7/32"	325	5/16"	15
1/4"	395	3/8"	15

Deposition Rates

DH-5 Electrode Size	DH-5 Amps.	DH-5 Deposit #/hr.	E-6012 Deposit #/hr.
3/16"	250	6.8	4.5
3/16"	280	7.9	
3/16"	320	9.6	
7/32"	300	9.0	5.8
7/32"	340	10.1	
7/32"	380	12.0	
1/4"	350	11.2	7.0
1/4"	400	12.8	
1/4"	450	14.7	

Try to match this for

You can't — unless you use the . . . .

Deposits up to twice as many pounds per hour as an E-6012

That's right, the DH-5 is in a class by itself, when it comes to high welding speed and sound deposits in horizontal and flat positions. It's Harnischfeger's answer to the demand for lower welding costs. It's your answer to the need for faster, better work.

Powdered metal in the coating becomes part of the deposit — increases thermal energy and efficiency. By simply dragging the DH-5, the operator gets the speed and bead appearance ordinarily associated with submerged arc welds.

Wherever they've tried it, weldors like the DH-5. It's fast, it's easy to use. There's no splatter. Slag removal is easy and quick. The bead shape is flat and smooth.

The DH-5 has good, as-welded, mechanical properties, too. See for yourself:

Tensile strength - - -	85,000-95,000
Yield strength - - - -	73,000-77,000
Elongation in 2" - - - - -	15-25%

If you're interested in your cost picture — and who isn't, today?—you owe it to yourself to try the DH-5 without delay. See your P&H representative or distributor now.

For further facts, write for bulletin.

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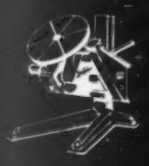
P&H DC RECTIFIER WELDER

Four sizes — 200, 300, 400 and 500 amps (NEMA-rated). No moving coils to break down — no bearings, brushes, commutator, brush riggings, etc. to replace. Dial-lectric Control gives you fingertip heat-control at the work.

P&H AC WELDER

A full range of sizes up to 625 amps (NEMA-rated). All are connectable to 220 or 440 volts. Dial-lectric Instantaneous Remote Control is fingertip control — gives you any heat you want, right at the work.



P&H POSITIONERS

One finger is enough to position heavy weldments for economical downhand welding. Capacities from 2500 to 36,000 lbs. — remote-control and hand-operated models.

P&H WN-250 ENGINE-DRIVEN ARC WELDER

NEMA-rated at 200 amps, but pulls 300 amps. Has full 20-gallon gas tank — runs all day on one tankful. Powered by four-cylinder, 180 GLU, Waukesha, water-cooled gasoline engine.

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GW-2—Coverall Welders Goggle

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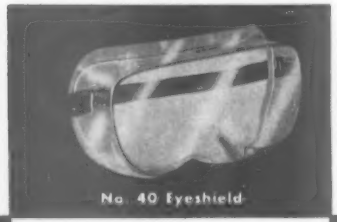
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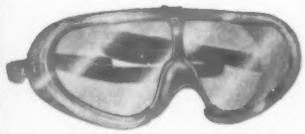
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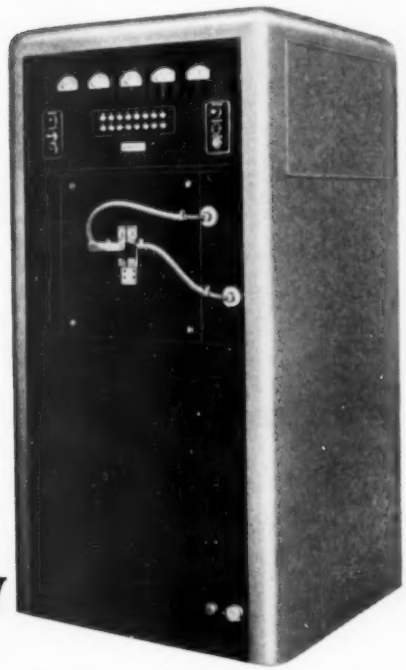
This development has also produced many advanced design features that are incorporated in control and heating stations used in connection with motor generator equipment.

Generators are available in power outputs from 30 kw. to 1250 kw.

Lindberg engineers are now equipped to solve your metal heating problems using optimum frequencies for specific applications from 60 cycles upwards. For information consult your nearest Lindberg field office or write for Bulletin No. 1460.



The High Frequency Division of Lindberg Engineering Company announces a complete line of MOTOR GENERATOR EQUIPMENT for all Induction Heating Applications

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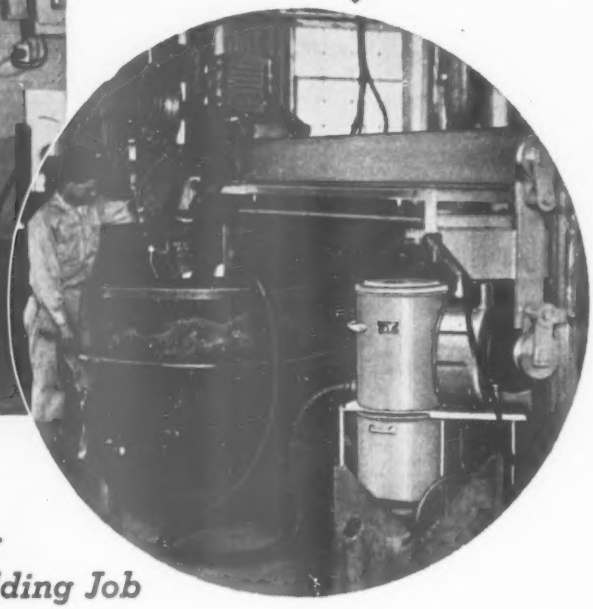
Salvaging flux the modern way with the portable Invincible Model 460.



there's a type "Tailor Made" for your Submerged Arc Welding Job

Invincible Flux Recovery Equipment is designed to save you money. Here is how Invincibles quickly repay their cost and give you years of trouble-free service:

Save VALUABLE FLUX —Invincibles recover all loose flux from the work, remove slag or fused particles, return the unfused flux to the hopper of the welder . . .

Eliminate COSTLY MAN-HOURS—Invincibles do the whole job automatically, more rapidly and efficiently than manual methods . . .

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Invincible users report big savings and complete satisfaction. These same results can be yours—there's an Invincible Flux Recovery Unit for any job, regardless of its size or type.

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Composite photo of one torch and jet mixer with three different welding tips, 13, 7 and 1.
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2. NEW JET MIXER
1. NEW CUTTING ATTACHMENT

The Airco Style 800 torch will handle any welding, heating or cutting job, thanks to the brand new Airco Jet Mixer and two completely redesigned cutting attachments.

The new Jet Mixer gives you perfectly stable flame control with all gas flows. Cyclonic action swirls the gases together, mixing them completely, within a tip size range from 0 to 14 inclusive. Rubber gas sealing rings provide a gastight seal with hand tightening, no wrench required . . . saves time in tip changes.

New heavy-duty cutting attachment takes all standard tips; cuts steel up to 8" thick! Medium-duty attachment available for lighter service. Both have rubber gas sealing rings, plus mixers which can be easily removed for cleaning, if necessary.

Owners of Style 800 torches can use the new Jet Mixer and cutting attachments with their present torches. For details, write to Air Reduction or see your Airco dealer, asking for your copy of Catalog 818, "Hand torches for gas welding and cutting."

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

at the frontiers of progress you'll find...

AIR REDUCTION PRODUCT

Divisions of Air Reduction Company, Incorporated, with offices and dealers in most principal cities

Air Reduction Sales Company
Air Reduction Pacific Company

Represented Internationally by
Airco Company International

Foreign Subsidiaries: Air Reduction Canada Limited, Cuban Air Products Corporation

Here's evidence of the superior flashback* resistance built into PREST-O-WELD TRADE-MARK BLOWPIPES

This is an actual excerpt from a recent Salesman's Report:

". . . The superintendent wanted to know what the PREST-O-WELD *W-122 blowpipe's characteristics were concerning flashback. I told him to go ahead and try it. He then lit a standard welding head and placed it against a block of wood six inches square. It bit its way into the block two inches deep before the tip of the welding head began to melt off. BUT ALL THE WHILE IT KEPT BURNING WITH NO FLASHBACK. . . ."*

We don't guarantee that every blowpipe can be maltreated this way with the same results. But that's the simple truth about the flame stability and flashback resistance of the PREST-O-WELD W-122 Blowpipe. Your present welding and heating work may not demand the limits of its outstanding performance. Still the reserve that's there—if and when you need it—is your continued assurance of steady, dependable operation and your safeguard against repair bills.

See for yourself the many additional features that put the PREST-O-WELD W-122 Blowpipe so far ahead of the field in economy, ease of operation, and low cost maintenance. Enjoy tomorrow's standards today. Ask your LINDE jobber for a demonstration. Or write to LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd Street, New York, N. Y.

* *"A flashback occurs when the flame disappears from the end of the tip and the gases burn within the torch or beyond the torch in the hose, usually with a shrill, hissing sound."*

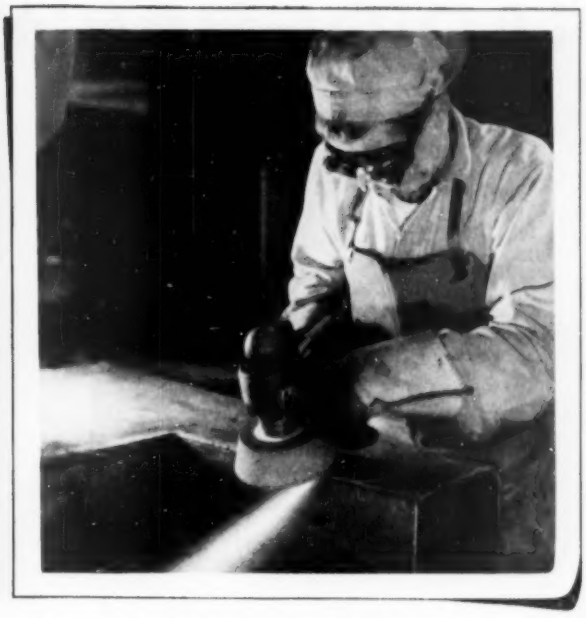
—Definition from THE WELDING ENCYCLOPEDIA, *Thirteenth Edition.*

Get it from your

LINDE jobber

The terms "Linde" and "Prest-O-Weld" are registered trade-marks of Union Carbide and Carbon Corporation.

JUST AS A NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a



POSITIVE DUPLICATION of an original wheel through the CINCINNATI (PD) Manufacturing Process.

Freer cutting action of CINCINNATI (PD) GRINDING WHEELS

Saves you money!

Ever increasing numbers of foundries and weld shops are making the important discovery that you can get more pounds of metal per hour with the grains and bonds specified by CINCINNATI for snagging jobs. And whether you use swing frame, stand or portable grinders, CINCINNATI (PD) WHEELS give you outstanding economy not only through freer cutting action . . . but through self-dressing action *and Positive* Duplication.

Just as a negative guarantees exact duplication of a photograph, the CINCINNATI (PD) *Manufacturing Process assures a Positive Duplication of the original wheel every time you reorder. Yet* CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

FREE! **Send today for your copy of the new fact-packed, illustrated pamphlet on CINCINNATI (PD) Snagging Wheels.**

Sales Manager, Cincinnati Milling Products Division
Cincinnati Milling Machine Co.,
Department E, Cincinnati 9, Ohio

Gentlemen:

I want to know more about CINCINNATI (PD) Snagging Wheels. Please send me a copy of "How To Reduce Snagging Costs and Increase Production."

NAME _____ TITLE _____

COMPANY _____

STREET ADDRESS _____

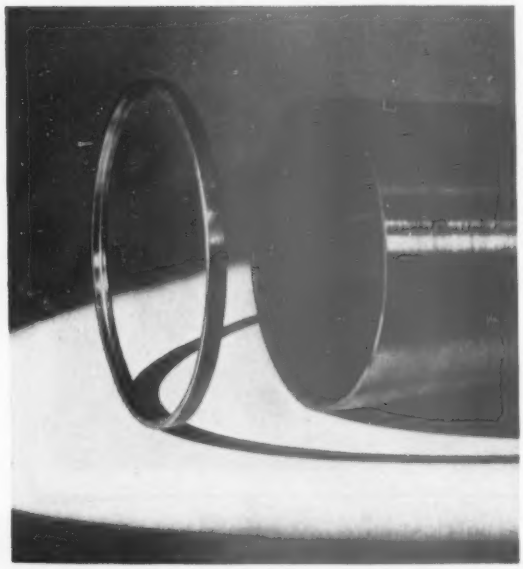
CITY _____ ZONE _____ STATE _____

Positive Duplication (PD) is the result of extensive manufacturing research and the development of new standards of manufacture with 36 quality control steps. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike—providing the *same fast cutting* of the original wheel, the *same long wheel life*, the *same reduced operator fatigue* and the *same self-dressing action*.

CINCINNATI (PD) WHEELS are made in vitrified and resinoid bonds for ferrous and non-ferrous foundries and weld shops. They are available in a complete variety of popular sizes and shapes. We'll be happy to tell you about our complete line of straight wheels, cups, cones and plugs, and to prove to you how CINCINNATI (PD) WHEELS will make money for you. Just contact us and we'll send one of our representatives. Wire, write or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

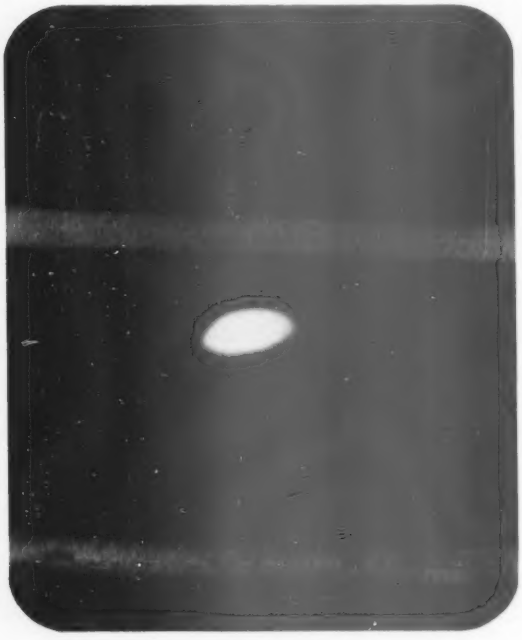
CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO
Cincinnati 9, Ohio

RADIOGRAPHY reveals...



This stainless steel ring must be brazed to the cylinder. The bond between them must be sound—for the ring must hold the cylinder in place despite high stresses.

a better way to yield a better job!



THIS IS where radiography has done a double job. First, x-rays probed the structure of the bond, showed when it met requirements or when lack of fusion meant the part must be rejected.

Then, radiography went further. It helped reveal a new technic for brazing these two parts—a technic which yielded sound joints almost every time.

So, add another instance where radiography is more than paying its way. By doing such jobs as this, by testing pipeline joints, by proving soundness of the welds in pressure vessels, it is opening up new fields to welders.

Radiography can help you build business as well as earn a reputation for good work. Would you like to discuss how? Talk it over with your x-ray dealer.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N.Y.

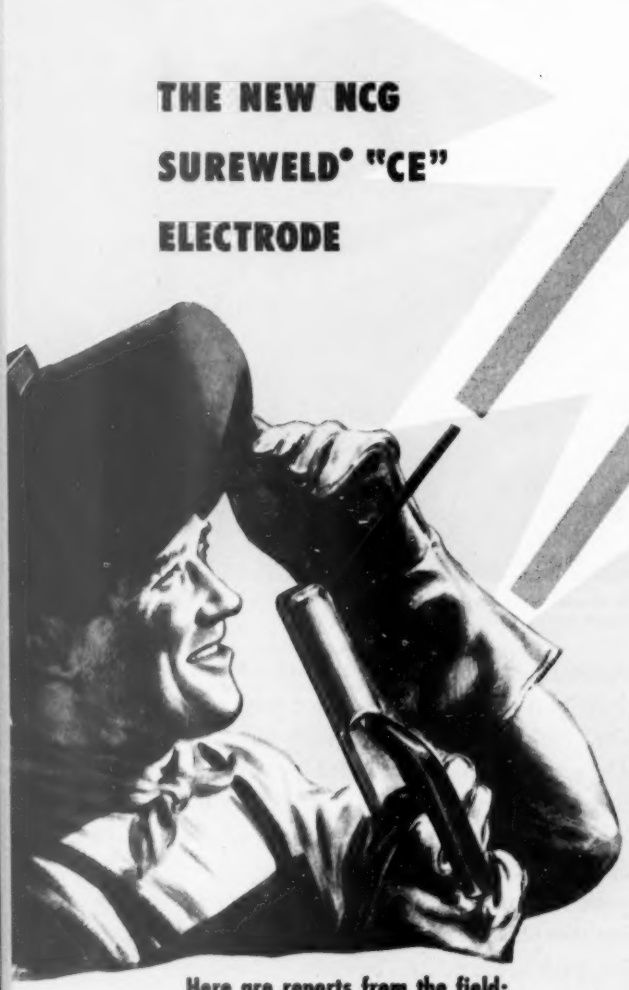
Radiography...

another important example of Photography at Work.

Kodak

Now NCG® creates a truly all-purpose all-position electrode for welding mild steel

THE NEW NCG SUREWELD® "CE" ELECTRODE



Here are reports from the field:

"The best all-around AC rod I've ever used."

"We are getting very good results with CE. And we like the way the slag practically drops off when cool."

"Beads have exceptionally smooth surface."

"In our book it surpasses any other E-6013 on the market."

"We think it's superior to all other 6013 electrodes in running characteristics."

"We find we can use it on more jobs than any other electrode we've tried."

NCG's new "CE" Electrode is designed to perform with maximum efficiency over a wider range of applications. It is usable in all positions with AC or DC straight or reverse polarity. Operators like this new rod because it is easy to strike and hold an arc, even with AC at low welding currents and low open-circuit voltages. There is little spatter; the arc is soft; action is quieter, with spray type metal transfer. Beads are smoother, with a fine, even ripple—free from pock-marks and slag inclusions. Slag deposits brush off easily. "CE" deposits with remarkable efficiency in any position. *Sureweld* "CE" conforms in all respects to E-6013 specifications. Your NCG dealer or nearest NCG office will be glad to demonstrate this new rod and let you try it for yourself. Contact him today.

NATIONAL CYLINDER GAS COMPANY
840 North Michigan Avenue, Chicago 11, Illinois

Branches and Dealers from Coast to Coast

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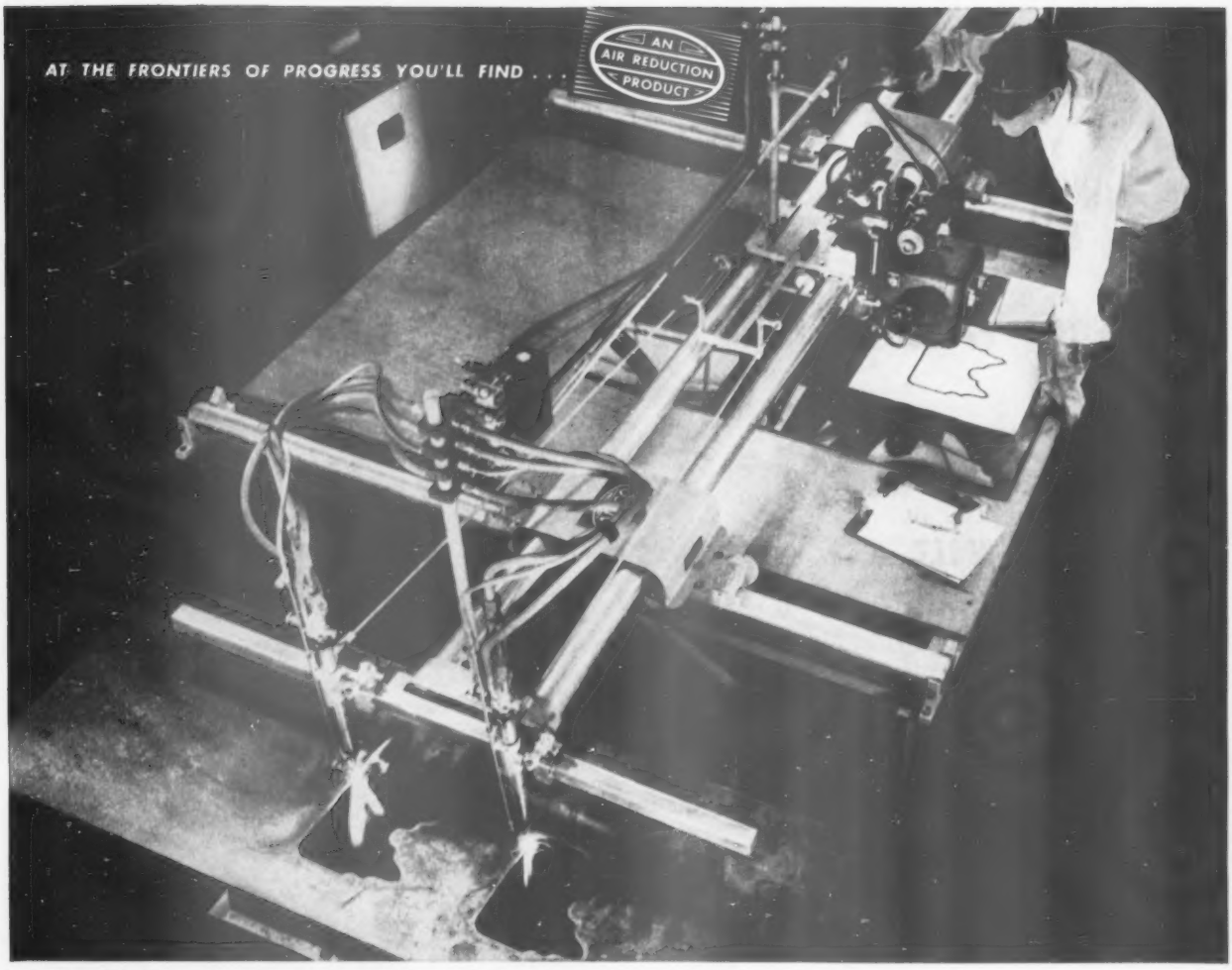
NCG®
EVERYTHING FOR WELDING



The Airco #48 Duograph cutting machine equipped with Electronic tracer. Note simple, sturdy construction and centralized control station. Basic tracing area 48" x 51". Cuts four 4-foot circles at once. Additional tracing table increases length to 131".

CLEAN, SHARP-EDGE CUTS. No scale or slag to remove. Duograph cuts so closely only a light grind or finishing operation is required.

Sound engineering and design give the Airco #48 Duograph the precision to produce close-tolerance parts as accurately as heavier, higher priced pantograph-type machines — Airco's Oxygraph or Travograph, for instance. For ease of operation, everything rolls — nothing slides. Sealed, precision ball bearings never need lubrication. Guide rails are cadmium-plated for resistance to corrosion.

Ask your Airco Representative for illustrated booklet containing complete details and specifications . . . or, if you prefer, write to the address below.

AIRCO

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

Divisions of Air Reduction Company, Incorporated, with offices in most principal cities

Air Reduction Sales Company
Air Reduction Pacific Company

Represented internationally by Airco Company International

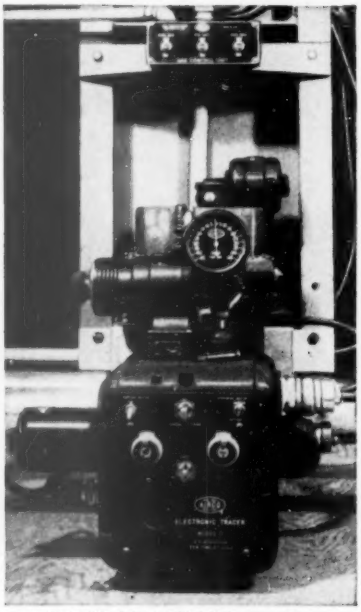
Foreign Subsidiaries:
Air Reduction Canada Limited,
Cuban Air Products Corporation

Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO — industrial gases, welding and cutting equipment, and acetylenic chemicals • PURECO — carbon dioxide, liquid-solid ("DRY-ICE") • OHIO — medical gases and hospital equipment • NATIONAL CARBIDE — pipeline acetylene and calcium carbide • COLTON CHEMICAL COMPANY — polyvinyl acetates, alcohols and other synthetic resins.

see it in operation at the Metal Show . . . Airco Booth #341

The NEW AIRCO #48 DUOGRAPH

the first rectilinear shape cutting machine that gives you the accuracy you want . . . at a price you can afford



CHOICE OF 3 TRACERS. Use the sure, accurate Airco Electronic Tracer, the magnetic tracer, or manual tracer, according to type of work. Tracer equipment is interchangeable.

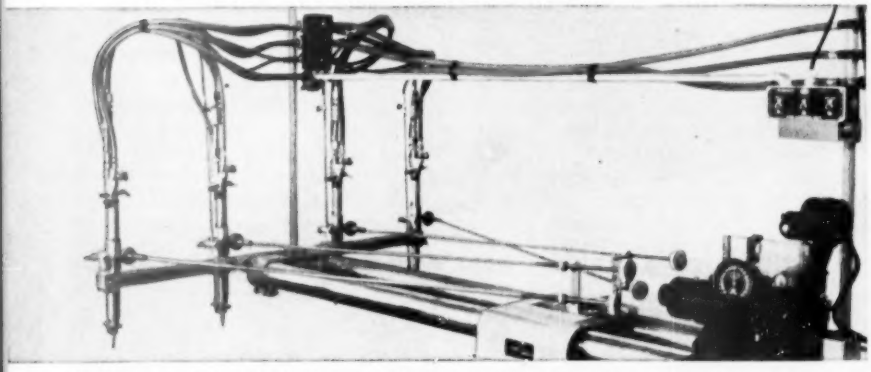
$3450*

featuring:

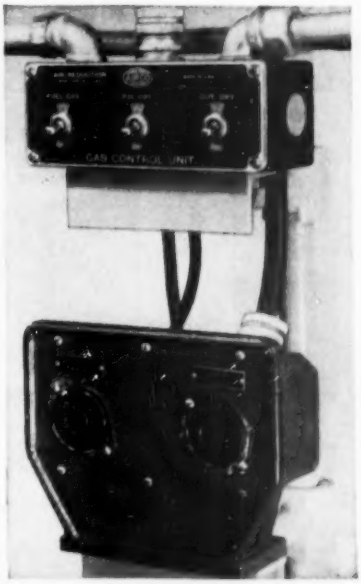
- **48" x 51" cutting area (one table)**
- **up to 4-torch operation**
- **centralized controls**
- **gas-saving solenoid valves**
- **accurate cuts**

***Includes:** Complete machine with 2 torches • ten Airco #45 high speed cutting tips • manual tracer • solenoid controlled gas distribution system • straight edge • radius rod • hose supports • tracing table • hose to torches

Other equipment available: Airco Electronic Tracer • Airco Magnetic Tracer • 2 additional torches • additional tracing table



MOUNTS UP TO 4 TORCHES. Torches clamp on mounting bar as illustrated. Easily positioned — 2 at left, 2 at right.



SOLENOID OPERATION — CENTRALIZED CONTROLS. Solenoid valve control saves gas. All controls grouped in central operation position — saves steps, speeds work.

AUTOMATIC TORCHES

THE HEART OF ECONOMY

Approved by Underwriters' Laboratories

BY ACTUAL COMPARISON

USING NON-AUTOMATIC TORCH . . . . . 12 Pieces Welded
USING NON-AUTOMATIC WITH GAS SAVER . . 18 Pieces Welded
USING HARRIS AUTOMATIC TORCH . . . . 28 Pieces Welded

Using the same amount of Oxygen and Acetylene for each set-up, this "Actual Comparison" Demonstration proved the Harris Automatic Torch to be a profitable investment for economical and efficient welding work.

Let our local Distributor show you the "Actual Comparison" test in your plant and explain quickly and simply why the Harris Automatic has the greater piece production at the lowest cost.

ALMOST 50 YEARS OF "KNOW-HOW"

Harris is the originator of the "Automatic" Torch and with almost 50 years of building "Know-How" behind every torch, the buyers and users get tremendous returns on their torch investment.

Harris' long established Distributors, located in all principal cities in the United States and Foreign Countries, are at your service.

HOME OF AMERICA'S FIRST AND FINEST GAS WELDING AND CUTTING APPARATUS.

THE HARRIS CALORIFIC COMPANY

Cleveland 2, Ohio

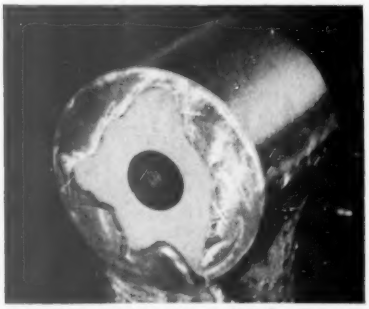
HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

THREE DIFFERENT BREAKS in two years. Each would have normally condemned this costly equipment to the scrap heap.

This 5-ton cast-iron column of a drop-forge hammer was braze-welded with Anaconda Tobin Bronze Rod

"We've done many jobs of this type," says Wilson E. Campbell, Sr., President of Industrial Welding & Brazing, Inc., Lansing, Michigan, "but repairing this 10,000-lb. column casting for a drop hammer was as tough as any. Yet we fixed it up not once but three times



REBUILT INSIDE AND OUT with Tobin Bronze. Large punch press connection was bored for the bearing and ground off outside.

—in three *different* places—each time as good as new.

"Last year," Mr. Campbell continues, "we repaired over a thousand different parts for *one* large auto maker. We did most of this work with Tobin Bronze—our favorite welding rod for over 30 years."

Why does Industrial Welding like braze-welding for repair work? It's economical and dependable, and needs less preheating. High stresses don't build up, and there is less danger of cracking.

Why Tobin Bronze* Welding Rod? Mr. Campbell reports: "Tobin Bronze Welding Rod flows freely—'tins' fast—bonds strong and sound. It's good for a wide variety of repair welds—engine blocks, cast-iron pipe, machinery parts and other equipment."

Purity Cylinder Gases, Inc., with headquarters at Grand Rapids and branches in western Michigan and northern Indiana, supplies Industrial Welding with all their rods. Like Purity, there are Anaconda distributors throughout the United States ready to help you with your welding problems—and to serve you with the Anaconda Welding Rod best suited to your particular repair and production job. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

*Reg. U. S. Pat. Off. 54139

ANACONDA®

WELDING RODS

Anaconda Copper-372 • Tobin Bronze-481 • Anaconda-997 (Low Fuming) Bronze • Nickel Silver-828 • Cupro Nickel-826 • Everdur-1010 • Ambraloy-928 • Phosphor Bronze-351 • Phosphor Bronze-354

Mallory Welding Electrodes Cover Many "Special" Jobs

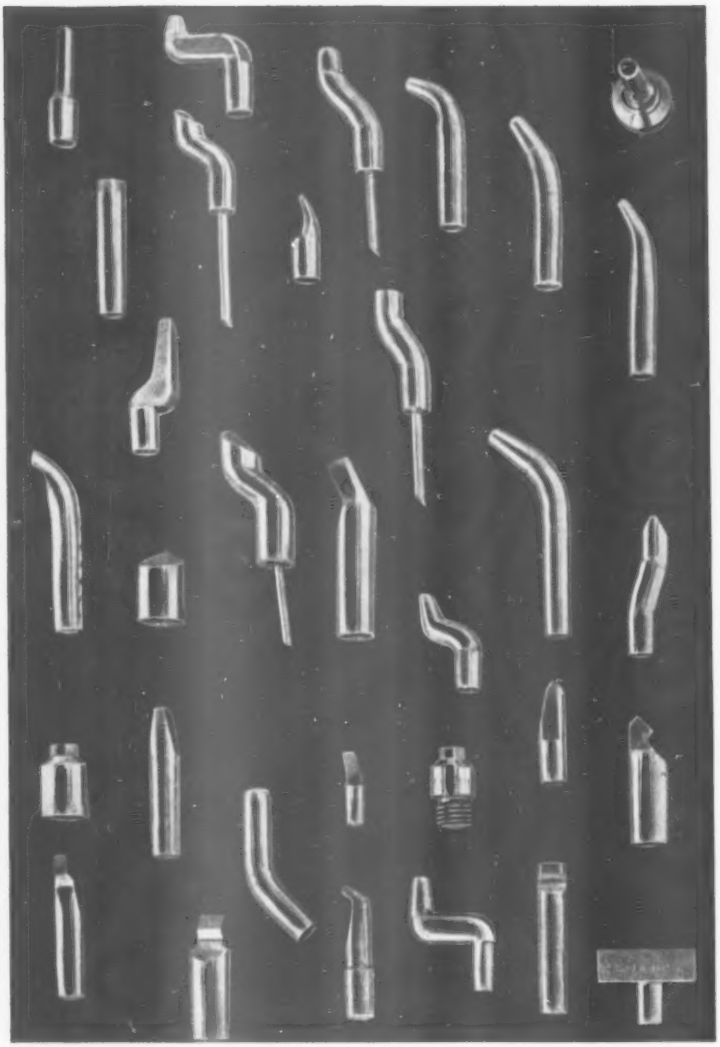
Odd-shaped resistance welding electrodes that you consider "specials" may well be standard items for Mallory. Just a few of the single-bend, double-bend and irregular shapes which we can supply are shown here. The complete list covers dozens of others, in a choice of sizes, tapers and alloys.

Many Mallory standard electrodes were once considered "special."

It will pay you to scan through the wide selection that Mallory offers, any time your welding work calls for electrodes that are out of the ordinary. Why not avoid the cost and delay of special tooling? And you will gain exclusive Mallory performance features that have been developed during more than 25 years of pioneering experience in the welding field.

Single- and double-bend electrodes, for example, are cold-formed by special Mallory techniques which produce maximum hardness and strength. The water cooling tube is bent in place by a patented Mallory process, to give better cooling and longer electrode life. Mallory's extensive selection of alloys permits an almost unlimited choice of physical and electrical properties for tips and inserts.

Mallory welding engineers will be glad to recommend standard electrodes for your application, or to design and produce special types for unusual requirements.



See Mallory for all your resistance welding materials

Available from Mallory is a complete line of straight and bent electrodes, holders, dies, forgings, castings and seam welding wheels. All are described in the latest edition of the Mallory Resistance Welding Catalog. Write for a copy today, or get one from your nearby Mallory distributor.

Expect More...
Get More from P.R. MALLORY & CO. MALLORY

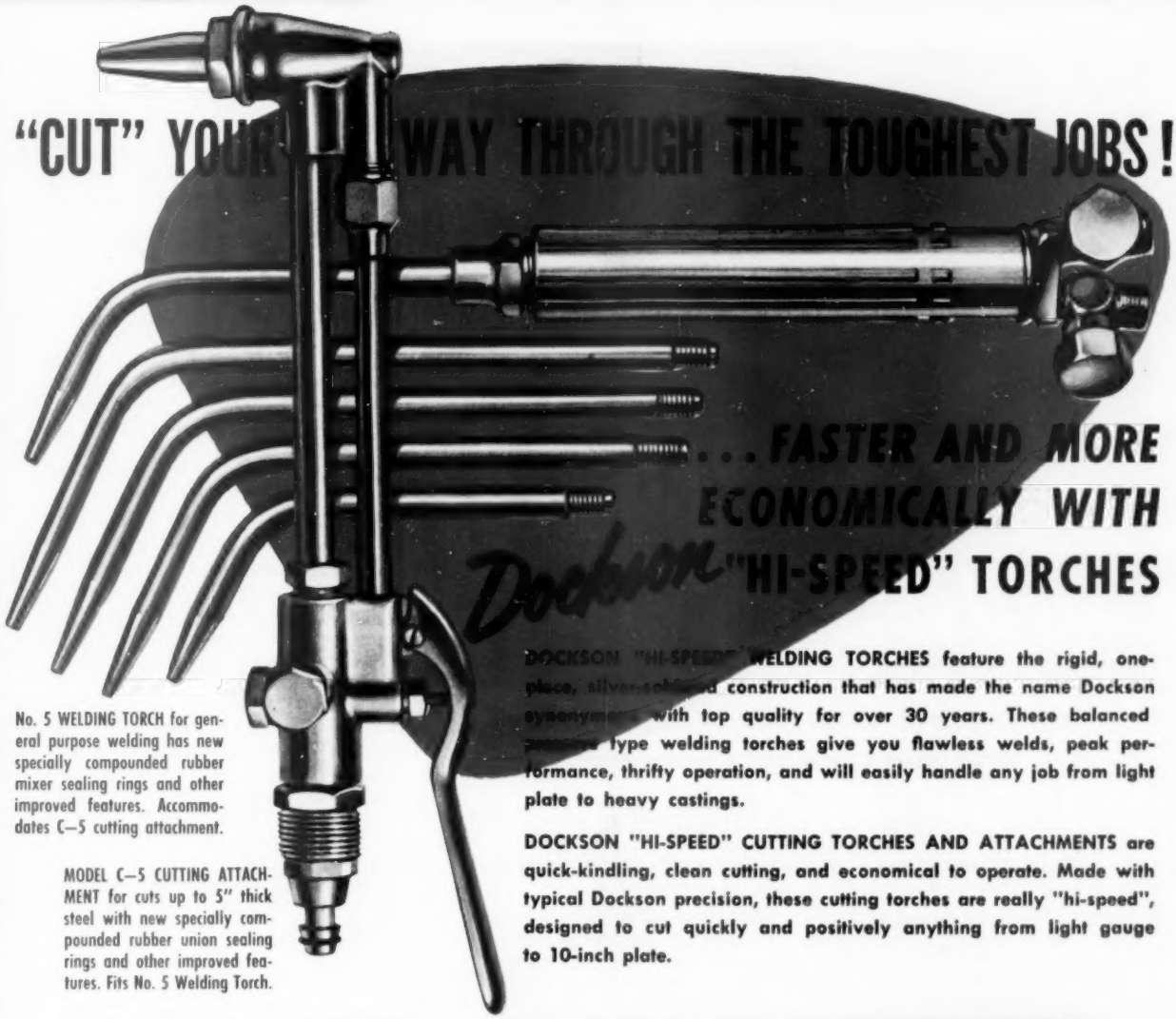
In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

"CUT" YOUR WAY THROUGH THE TOUGHEST JOBS!



. . . FASTER AND MORE ECONOMICALLY WITH Dockson "HI-SPEED" TORCHES

No. 5 WELDING TORCH for general purpose welding has new specially compounded rubber mixer sealing rings and other improved features. Accommodates C—5 cutting attachment.

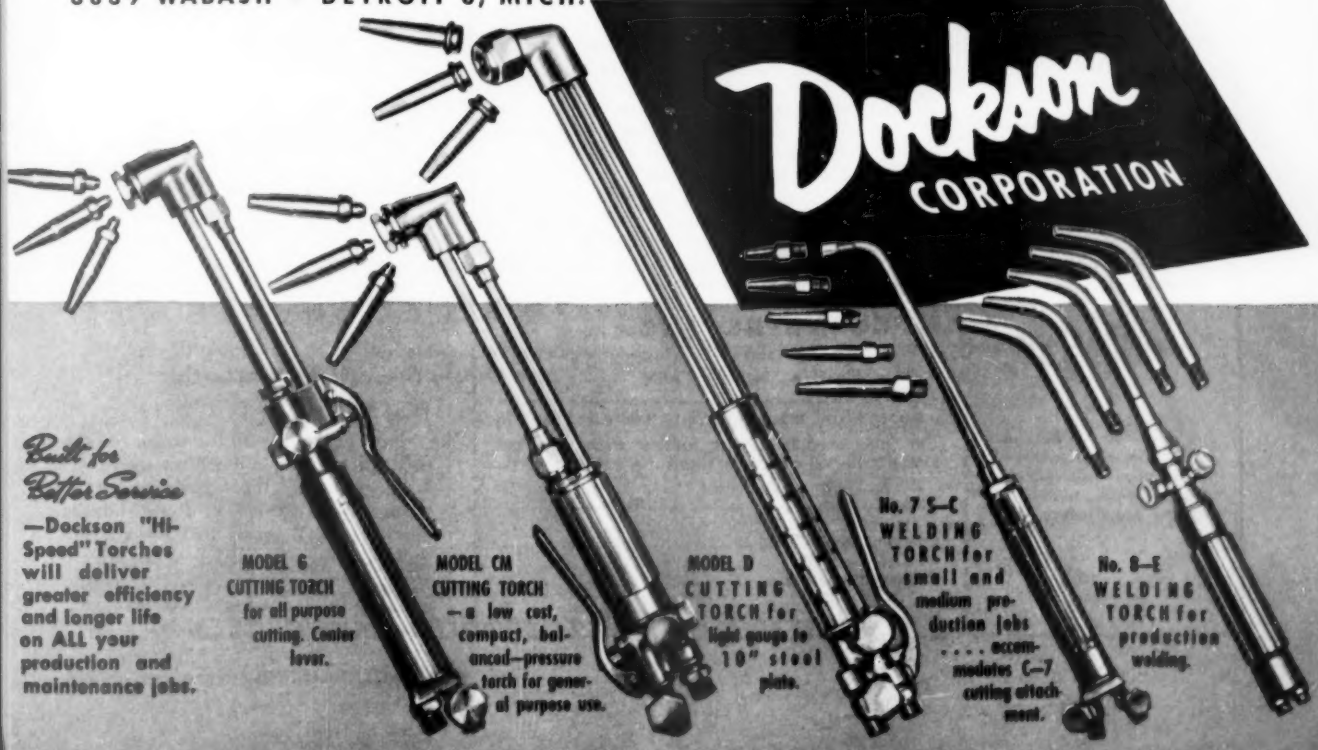
MODEL C—5 CUTTING ATTACHMENT for cuts up to 5" thick steel with new specially compounded rubber union sealing rings and other improved features. Fits No. 5 Welding Torch.

DOCKSON "HI-SPEED" WELDING TORCHES feature the rigid, one-piece, silver-soldered construction that has made the name Dockson synonymous with top quality for over 30 years. These balanced pressure type welding torches give you flawless welds, peak performance, thrifty operation, and will easily handle any job from light plate to heavy castings.

DOCKSON "HI-SPEED" CUTTING TORCHES AND ATTACHMENTS are quick-kindling, clean cutting, and economical to operate. Made with typical Dockson precision, these cutting torches are really "hi-speed", designed to cut quickly and positively anything from light gauge to 10-inch plate.

3839 WABASH • DETROIT 8, MICH.

Dockson CORPORATION



Built for Better Service

—Dockson "Hi-Speed" Torches will deliver greater efficiency and longer life on ALL your production and maintenance jobs.

MODEL G CUTTING TORCH for all purpose cutting. Center lever.

MODEL CM CUTTING TORCH —a low cost, compact, balanced—pressure torch for general purpose use.

MODEL D CUTTING TORCH for light gauge to 10" steel plate.

No. 7 S—E WELDING TORCH for small and medium production jobs . . . . accommodates C—7 cutting attachment.

No. 8—E WELDING TORCH for production welding.

You can get wear-resistant overlays with the hardness you want

Use AMPCO-TRODE* Electrodes and Filler Rod

Take your choice of ten deposit hardnesses

Get the right weld deposit hardness every time you make a wear-resistant overlay. Stock all five grades of Ampco-Trode electrodes and filler rod and you're ready for practically any job where metal-to-metal wear threatens you with downtime or production grief. Here's the Ampco-Trode lineup that assures the hardness you need.

Electrodes & Filler Rod	Deposit Hardness Metal-Carbon-Arc	Deposit Hardness Inert-Gas
Ampco-Trode 10	130-150	160-190
Ampco-Trode 160	150-170	190-220
Ampco-Trode 200	180-220	250-280
Ampco-Trode 250	230-270	310-340
Ampco-Trode 300	280-310	350-380

Here's something else! You can apply these hard bronze alloys by almost any process—whichever way meets your particular needs best — by metal-arc, carbon-arc, MIG, TIG, or submerged-arc. However you do it you get an overlay with remarkable life in severe metal-to-metal wear applications. It's ideal for adding extra life to bearings, bushings, sheaves, gears, pinions. It gives real stamina to sprockets, wear strips and plates, shafts, drawing and forming dies, and other tough applications. In some cases the service life of machine parts has been increased up to 5000% through use of Ampco-Trode facings.

You're money ahead — your machines last longer, perform better when you use wear-resistant Ampco overlays. Send the coupon for complete information today.

*Reg. U. S. Pat. Off.

AMPCO®

AMPCO METAL, INC.

Dept. WE-11 • Milwaukee 46, Wisconsin

West Coast Plant • Burbank, California

W-128

Free — Bulletin W-17 with complete information about welding with Ampco Bronzes. Send coupon for yours today.

Ampco Metal, Inc., Dept. WE-11, Milwaukee 46, Wis.

I'm interested in saving money with wear-resistant Ampco overlays. Send me bulletin W-17.

Name.....Title.....

Company Name.....

Company Address.....

City.....(.....) State.....

Letters should be addressed to: The Editor, WELDING ENGINEER, 330 W. 42nd St., New York 36, N. Y. No letter will be published unless signed, but your name will be withheld if you request it.

A weldor's woe

Dear Sir:

Your cartoon sheet, "A weldor's woes," is most enjoyable.

I am employed in a jig-building shop at an airplane plant. One of the jig weldor's gripes is: when a jig builder brings two pieces of pipe into a weldor's booth, lays it on the table, and says, "Weld this up, will ya?" After a brief examination of the pieces to be welded, the weldor finds that he can darn near put his foot between the pipes that are to be welded (because of a poor fit-up).

My comment to the jig builder who brings in some work that isn't fitted properly is: "What you're looking for is a magician, not a weldor."

Many of us use this expression.

Sincerely,
Disgusted Weldor

* * *

"Cranky crankshafts"

Dear Sir:

Just received an inquiry from a company in Wisconsin regarding an article they read on our process in WELDING ENGINEER ("Cure for cranky crankshafts," September, 1954).

We would appreciate your sending us a copy.

Cordially yours,
W. A. Allen
Vice-President
American Crankshaft Co.
Charlotte, N. C.

* * *

Weldor vs. welder

Dear Sir:

I am in trouble on the word "weldor" which means a machine operator. I have made the statement, and strongly, that anyone in doubt should please check Webster on the matter.

Woe and behold—if Webster's Unabridged International Dictionary did not state the following: **"welder:** one

(Continued on page 28)

MANUFACTURERS OF HIGH-QUALITY ELECTRIC ARC AND SPOT WELDERS SINCE 1929

IN HONOR OF OUR

25th ANNIVERSARY

WE PROUDLY PRESENT

miller TA-250 SERIES Tungsten Arc Welders

WITH *Unitran*

Here is a series of *electrically* controlled A.C. welders designed for the tungsten arc process—a combination of the widely recognized welding characteristics of famous Miller 200 Series Welders *plus* the unique features of Miller's patented **UNITRAN** control circuit.

UNITRAN unites, electrically, a Miller-built transformer with its own *integral* flux diverter. This eliminates the need for any mechanical type of current control, and along with optimum open circuit voltage, high frequency generator and balancing resistor, insures superior *quality* and *flexibility* throughout the entire welding range.

UNITRAN has no moving parts, assuring minimum maintenance and quiet operation; permits a wide variety of remote operations, including hand and foot remote control.

All models are power factor corrected, convert for use with shielded arc electrodes at the flick of a switch. A full line of running gear, self-contained coolant systems, remote current and gas-water controls is available.

Write for free, complete, informative literature on our 25th Anniversary TA-250 Series . . . you'll be glad you did.

MODEL	CURRENT RANGE	RATED OUTPUT	DUTY CYCLE
TA-251-P	5-250 amperes	150 amperes	100%
TA-252-P	10-400 amperes	235 amperes	100%
TA-253-P	15-600 amperes	350 amperes	100%

miller

ELECTRIC MANUFACTURING COMPANY Inc. • Appleton, Wisconsin

RACO COSTS NO MORE ... SOMETIMES LESS gives you UNINTERRUPTED

MILD STEEL • MEDIUM CARBON • LOW ALLOY
ALUMINUM • BRONZE • SPECIAL PURPOSE ALLOYS
CHROME-MOLY • STAINLESS • NICKEL • TITANIUM

THREADWOUND COILS
WIRE ON SPOOLS • CATCHWEIGHT COILS

STRAIGHT LINE FEED OFF—Threadwound coils assure straight line feed off. Final reduction to finished size is made on rewinding machines. All butt welds are pulled through finishing die eliminating bumps, kinks and cross overs. All coils have a cast placed in them with a four-inch maximum expansion . . . coils stay in place when tie bands are cut, avoiding looping over sides of pay off reels.

STEEL BANDS STIFFEN COILS—Threadwound coils are now being wound on corrugated steel bands for added stiffness.

UNIFORM WEIGHT—Threadwound coils are of uniform weight, automatically controlled by our rewinding machines.

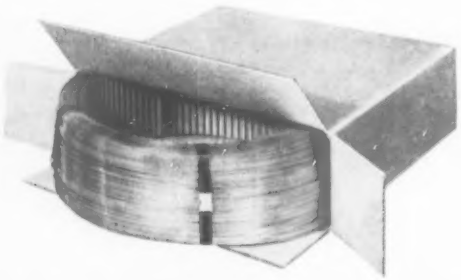
PALLETIZED CARDBOARD CARTONS—Threadwound coils are packaged in cardboard containers, then steel strapped on pallets manufactured in our own plant.

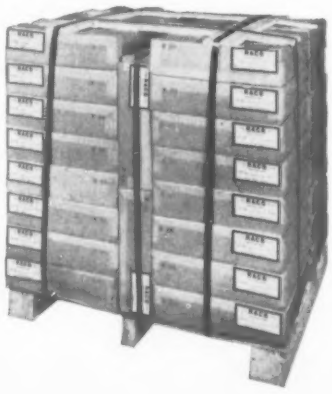
ENDS OF COILS—Back end of each coil is securely anchored to corrugated steel band . . . starting end is marked with colored tag and left straight for feeding automatic machines. No cutting or straightening needed.

ALL COPPER-COATED WIRE IS ELECTRO-PLATED

MODERN MANUFACTURING FACILITIES—We have complete and modern continuous wire drawing equipment, descaling and acid cleaning for hot-rolled wire rod. Annealing and normalizing equipment. We have fourteen wire straightening and cutting machines, and can furnish straightened and cut lengths up to 36″, in sizes $\frac{1}{32}$″ to $\frac{5}{16}$″. Catchweight coils up to 400 lbs. Threadwound coils in all standard widths and I.D. . . . all standard size spools.

MANUAL ELECTRODES AND GAS RODS—Available in 50-pound cartons, shipped on pallets at no extra charge.





what it takes for

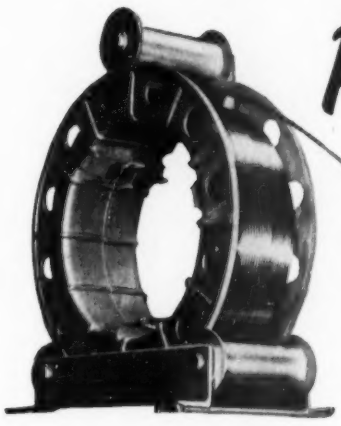
AUTOMATIC ARC-WELDING

RACO COMPOSITE TYPE "A"

Heavy Coated Open-Arc Electrode. Available in mild steel, low alloy-high tensile, low hydrogen, hard surfacing and stainless steel grades. Two other grades for open-arc welding—RACO TYPE "D" with white flux coating and RACO TYPE "M9" (knurled) with red flux.

plus

THE LATEST IN LABOR-SAVING EQUIPMENT



RACO FREE WHEELING REELS—SAVE DOWN TIME by using larger Raco coils. Ball-bearing trunnions enclose the coil so there is no overrun or loose strands and larger coils can be used. Changing coils is a matter of only a few seconds and no tools are required. Available in 12, 14, 25 and 36 inch sizes, for any weight from 50 to 200 pounds.

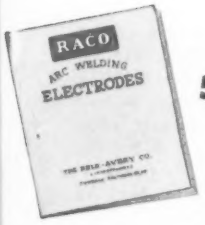
FOR SUBMERGED ARC-WELDING

The New RACO Model BW-2

Outstanding features are:

1. Adaptability to any job . . . nozzle can be positioned 360° in two planes.
2. Simplified control for either standard or constant potential welders, AC or DC.
3. Easy to install . . . just plug in head and hook up welding cables.
4. Available with various nozzles and attachments for submerged-arc, gas-shielded arc, or open-arc welding of all kinds. Also duplex nozzles and feed rolls for twin arc-welding.
5. Trouble-free operation . . . only three moving parts.

THE RACO TYPE 4R automatic head and controls are designed and furnished for use with RACO composite Type "A" wire.



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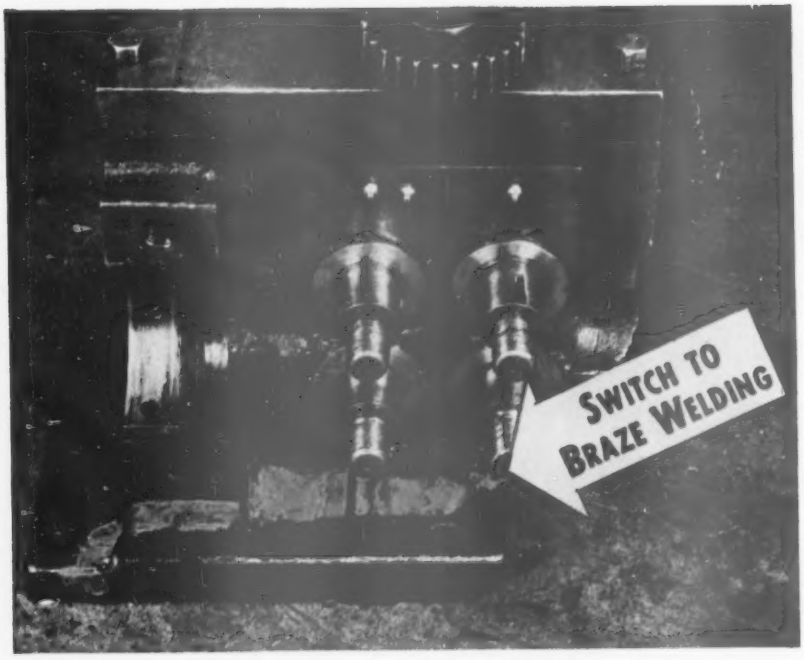

Save time and money

...get stronger, faster welds with Bridgeport No. 192 Low Fuming Bronze Rod

Long heavy-duty operation cracked this feedroll housing on a rod straightening machine. Braze welding with Bridgeport No. 192 Low Fuming Bronze Rod had it back in service in a matter of hours. This is typical of the many time and money-saving operations you can make with this versatile rod in your shops.

Bridgeport No. 192 is a low fuming magnesium type rod for all-purpose welding. It is especially recommended for repairing castings and forgings, for building up worn surfaces, and for production line fabrication. No. 192 tins readily with only local preheating and gives a weld that is frequently stronger than the original base metal.

We'd like to tell you the whole story on the economy and performance of Bridgeport No. 192 Low Fuming Bronze Rod and other Bridgeport Braze Welding Alloys. It's in our booklet "Braze Welding Alloys" which is yours for the asking. Write for it today.

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who or that which welds, as (a) a machine used in welding, (b) one whose work is welding."

I am very much in favor of the letter "O" inserted to designate the operator, but unless you can give me concrete evidence, I am sunk.

Please come to my rescue as soon as possible.

Thanks,
E. T. Bishop
Foreman
Metal Working Shops
Signal Maintenance Div.
San Antonio, Texas

Mr. Bishop has been referred to our September editorial, "It's in the dictionary," which told how "weldor" has been inserted in the latest edition of Webster's New Collegiate Dictionary.

* * *

May issue was sent

Dear Sir:

I am interested in obtaining information as to the comparative amounts of welding materials used during recent years as opposed to years previous to World War II. The National Electrical Manufacturers Association suggested that the May, 1954, issue of WELDING ENGINEER gave some of the statistics.

I would like to obtain a copy of the issue.

Sincerely yours,
Frank J. Havlen
Instructor
North Syracuse Central Schools
North Syracuse, N. Y.

* * *

Not really "magic"

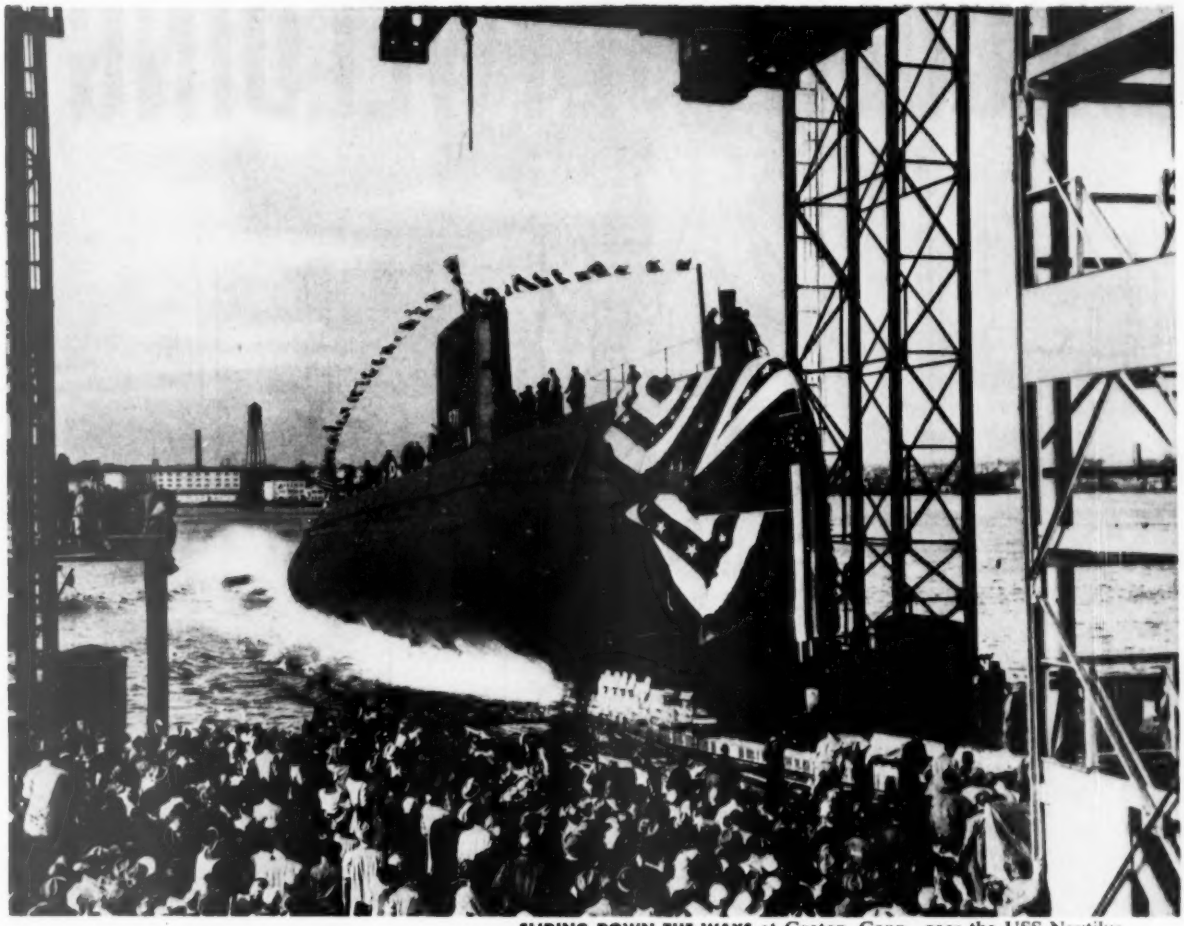
Dear Sir:

We are anxious to know what that magic powdered compound is that Pete used on his bit. ("Pete does his 'bit,'" WELDING ENGINEER, July, page 31.)

Please send us all pertinent information.

Very truly yours,
Fred Johnson
Fred Johnson Steel Co.
New York City 36

The compound Pete used is available from many welding supply houses. To mention just a few such powders: "Armor-Tuf," Armor-Tuf Sales Corp., 299 Madison Ave., New York City; "Hard-N-Tuff," Doughty Laboratories, Inc., 500 Fifth Ave., New York City; and those case-hardening and tempering compounds made by Eutectic Welding Alloys Corp., Flushing, N. Y., and All-State Welding Alloys Co., Inc., White Plains, N. Y.



SLIDING DOWN THE WAYS at Groton, Conn., goes the USS Nautilus, newest and fastest member of our underseas fleet. During welding, Worthington heavy-duty turning rolls rotated the hull sections.

How the world's first atomic sub was welded

Welding the hull of the USS Nautilus, world's first atomic submarine, presented a tough problem.

Submerged-arc automatic welding seemed to be ideal for the job. Question was — could you rotate the hull sections of the Nautilus to take advantage of this fast, high-quality, welding method?

Worthington's answer to General Dynamics Corporation's Electric Boat Division, builder of the Nautilus, was the largest turning roll ever built.

The result? Welding of the Nautilus hull was accomplished in record-breaking time — and cost less than originally estimated. Unchanged, the Worthington roll set-up is also being used in the construction of the nation's second atomic sub, the USS Sea Wolf.

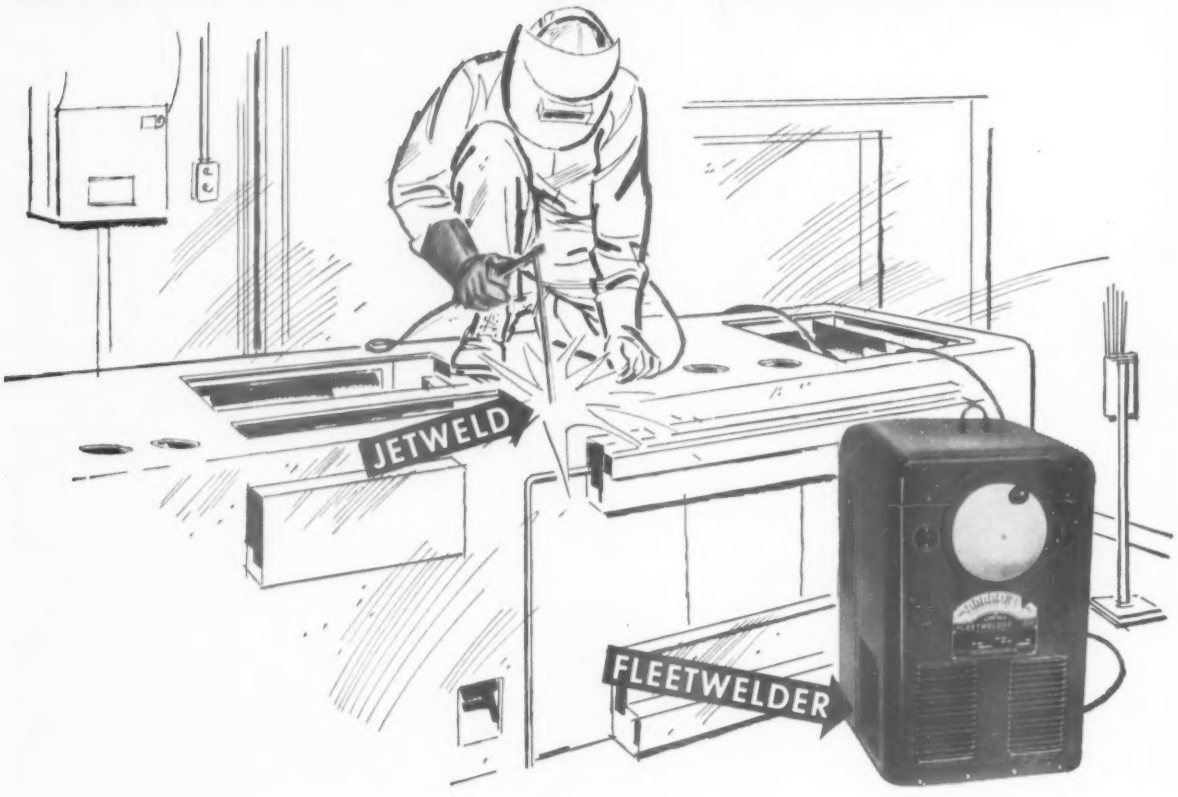
You can count on this kind of performance from all Worthington turning rolls and positioners. They're precision-made for tough assignments. You can also count on them to cut your welding costs and boost production. For details, write for Bulletin 228A to Worthington Corporation, Positioning Equipment Division, Section Y.4.4, Plainfield, N.J.

Y.4.4A

WORTHINGTON

Welding Positioners • Turning Rolls

LINCOLN "JETWELDING"



...industry's greatest team for low cost, high speed hand welding

Lowest manual welding costs are achieved with "Jetweld", the high speed welding electrode developed and introduced by Lincoln, and "Fleetwelder"—Lincoln's AC transformer-type welder.

For the first time, "Jetweld" utilizes powdered metal in the electrode coating . . . enabling use of higher currents to speed welding. Iron powder becomes an additional source of metal for the weld. Welds are more uniform, free of undercut, of X-ray quality.

THE RESULT: Average increases in speed of 35% . . . *and more.*

CHECK LINCOLN'S NEW LOW PRICES
Lincoln's new combination of lower AC machine prices and faster welding with "Jetweld" can cut your welding costs. See for yourself. Have your Lincoln representative check your requirements for electrodes and welders. Call or write.

THE LINCOLN ELECTRIC COMPANY
Dept. 1710
CLEVELAND 17, OHIO
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

ESTABLISHED 1916 **Welding Engineer** NOVEMBER, 1954

Welding of today and tomorrow

ONE HUNDRED AND TEN years ago, a Commissioner of Patents resigned from office. In handing in his resignation, he said something to this effect:

"I am of no further use. Everything that can be invented has been, and there is no further need for a Commissioner of Patents."

The lack of vision of that man—his lack of faith in the future of America—has been handed down to us these many years as a classic example of how wrong a forecaster can be.

In 1844, when there was nothing new to be invented, welding was inconceivable except by the primitive method of the village blacksmith. The Commissioner of Patents is perhaps not to be censured too much because it would be nearly 60 years before any man, anywhere, knew more than the village blacksmith about welding. And then another 50 years would go by before welding achieved its present status.

Just for fun, let's suppose that the sleepy old Dutchman, Rip Van Winkle, was a weldor and that he took a 25-year nap in 1929. When Rip woke up and reported back for work, he would have trouble even in naming the present welding processes.

In Rip's 1929 welding day, electrodes were known to the trade as "welding wires" and were usually sold bare, though a few newfangled electrodes of the coated type were beginning to make their appearance. What would Rip say to submerged-arc automatic welding? Or to Mig and Tig welding? They wouldn't be welding at all, as he recognized it.

LET'S stop feeling so superior to Rip Van Winkle. Tomorrow will bring new welding processes that you and I are unable to imagine.

The 75-year wave of electrical development that began when Thomas A. Edison invented the first electric incandescent lamp on October 21, 1879, may have reached its crest, but there is another big wave coming up in the immediate future. I'll name it for you—atomic energy. The next 25 years are going to find considerable industrial activity and inventive ingenuity being devoted to converting industry to the position of using atomic energy advantageously.

Will welding remain unaffected? To think so is to display no more foresight than our 1844 Commissioner of Patents. Why not an atomic welder? I don't mean something on the order of the atomic-hydrogen welding process, but a welder that is able to make the atoms of adjacent surfaces reach out and grasp each other's hands. As tightly as atoms are joined into molecules.

Call me a dreamer, a science-fictionist or even a "hop head" if you want to. I believe that sort of welding is someday going to take shape.

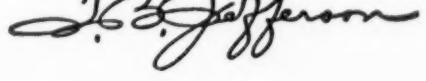
THIS device should be the ultimate in welders and should know no limitations. It will operate at extremely high speed and will not require special preparation of materials before welding, nor flux, nor any kind of atmospheric shielding, nor even filler material. All these aids to present welding are unnecessary if the atoms can be induced to shake hands.

The atomic welder will be able to join materials as dissimilar as white pine and alloy steel with a perfect bond. It will weld wood, glass, ceramics or what have you. Imagine a perfect bond between the glass of a window and its aluminum frame. Atomic welding will make such phenomena commonplace.

How will it be done? I confess I do not know, but I can visualize the materials to be joined being butted together while the atomic welder is run along the joint. Somehow it will break up the molecules on either side of the joint, mix them up thoroughly and then "freeze" them again into a perfect bond, regardless of the materials being welded.

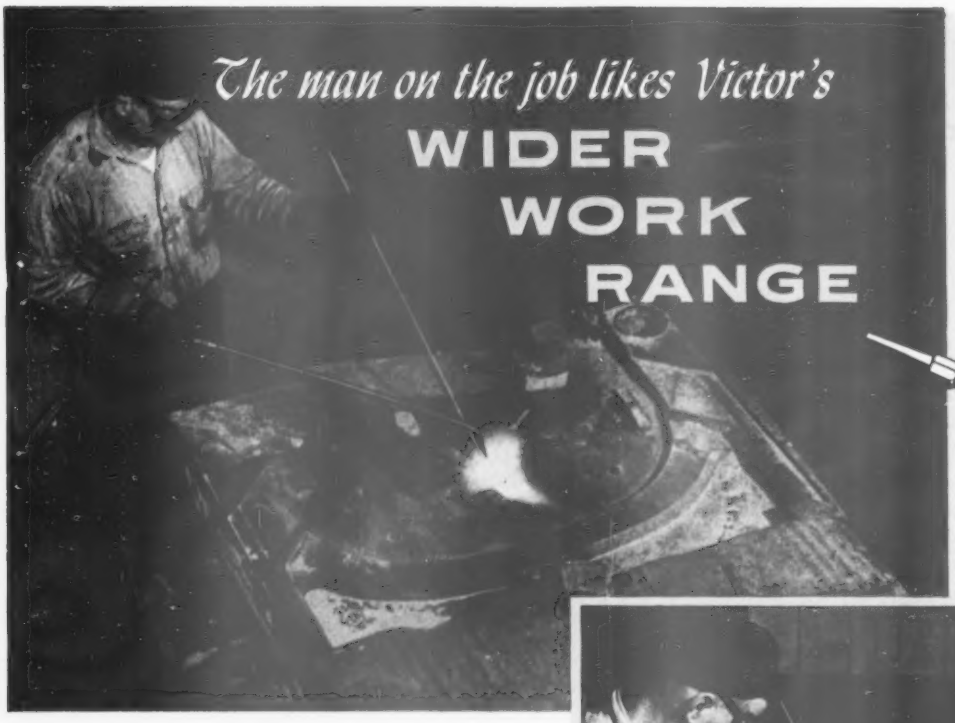
It *is* in the future, though it may be far away. Some of the other things coming up, not so far away, will be:

Overhead automatic welding; Mig and Tig welding of *all* metals and alloys; wider use of carbon dioxide and nitrogen as shielding gases; a greater play on powdered metals in welding. I prophesy also that some new and amazing uses of the oxyacetylene flame are in the offing. You don't believe me? Just wait and see.



The man on the job likes Victor's

WIDER WORK RANGE



Using a VICTOR No. 310 torch butt with two S2 extensions and No. 8 type 4 tip, Joe Wyman (Shreve Welding Co., Oakland, Calif.) repairs cast iron heating boiler header with VICTOR No. 1 low fuming manganese bronze rod. Inset photo shows 5/64" build-up on undersize castings, done with same No. 310 torch but with No. 5 type 4 nozzle and VICTOR No. 6 square cast iron rod.

VICTOR'S wider work range pays off from the day you select your first VICTOR welding outfit on through a lifetime of reliable service. You buy the torch you need for your present work, add extensions, cutting attachments or special nozzles as they're needed. Result: top-quality equipment that's always perfectly matched to your needs!

Whatever the job . . . welding, cutting, heating, brazing, descaling . . . you'll start it quicker, finish it sooner with versatile VICTOR equipment!

VICTOR for welding

LOOK FOR THE VICTOR DEALER SIGN *. . . ask him to show you why it costs less to own and operate VICTOR.*

VICTOR EQUIPMENT COMPANY

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Mfrs. of welding & cutting equipment; hardfacing rods; blasting nozzles.

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NEW

developments of the welding year

(as reported in the pages of WELDING ENGINEER)

BY CLYDE B. CLASON

NEW processes, improvements to existing processes . . . these constitute the lifeblood of an industry. Outstanding proof that the welding industry has healthy corpuscles of invention swimming around in its bloodstream is offered by the 1954 pages of WELDING ENGINEER.

NEW WELDING PROCESSES

No less than four processes so different in their nature as to justify the classification of "new" have been reported this year. These are: slag-gas arc welding, magnetic-flux welding, ultrasonic fluxless soldering and high-frequency butt welding. To make a quick inspection:

Slag-gas-shielded arc welding (pp. 38-39, July, WELDING ENGINEER) uses a coiled tubular electrode that has the flux contained within the cavity of the tube. The flux core melts and is transferred through the arc to become a molten blanket of slag. A separate shielding gas (carbon dioxide) protects the arc column from oxidation. The process is applicable to either automatic or semiautomatic welding.

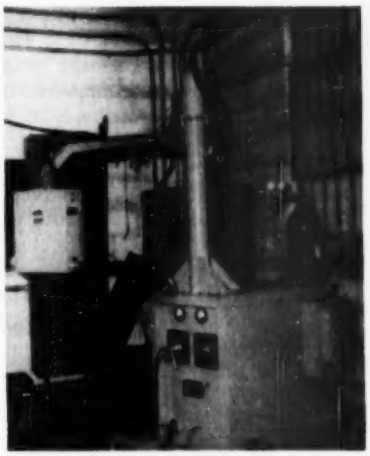
Magnetic-flux welding (p. 57, February, WELDING ENGINEER) is a refinement of a radical nature to the semiautomatic submerged-arc process. The term "flux" does not refer to magnetic induction but is used in its ordinary welding meaning. The flux is made of a magnetic alloy, which clings to and coats the wire immediately ahead of the welding arc. For more details, see page 52.

Ultrasonic fluxless soldering (pp. 26-27, September, WELDING ENGINEER) is done by means of magnetostriction. Without attempting a definition of this long word, a high-frequency alternating current creates a magnetic field that flickers on and off thousands of time every second. The result is a series of vibrations so extremely rapid as to be in the ultrasonic range. Transmitted from the magnetostrictive transducer coupling of the soldering head, the ultrasonic energy is sufficient to break down even heavily oxidized surface film on aluminum.

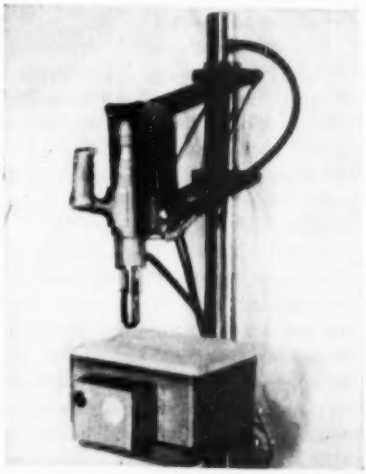
High-frequency butt welding (pp. 24-26, March, WELDING ENGINEER) is a more specialized process. Though in regular service at the Vapor Heating Corp., Chicago, for the fabrication of steam coils, the equipment has not yet been offered on the market. A single-turn copper coil does the job of butt welding pipe lengths. The pipe handled is around an inch in diameter and has a wall thickness ranging from a minimum of 0.113 in. to a maximum of 0.179 in. The pipe has to be rotated during welding, which introduced many troublesome mechanical problems to be solved.

IMPROVED WELDING PROCESSES

An oscillating automatic welding head (p. 70, June, WELDING ENGI-

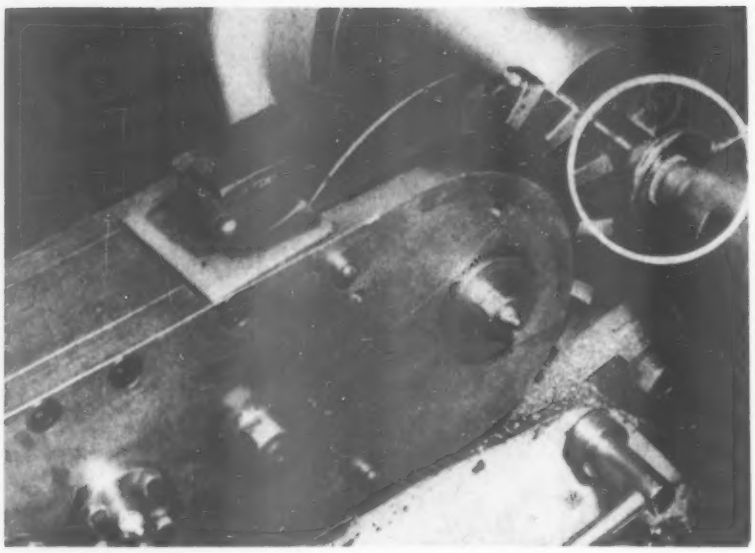


EQUIPMENT for slag-gas process



ULTRASONIC fluxless soldering

BEAM of light locates spot welds



BUTT welding pipes by high-frequency current. Circle shows heating coil

NEER) spreads the arc to produce beads up to a maximum width of 4 in. Device is applicable to submerged-arc automatic welding heads only. Further details will be found in the article beginning on page 36 in this issue.

Waxless thermit welding (pp. 26-27, January, WELDING ENGINEER) avoids the customary preheating to melt out the wax. Instead of making first a wax pattern and then a sand mold around the thermit joint, a pair of factory-made molds are used. All of the materials needed for one joint are packed and shipped as a unit: the two halves of the mold, a bag holding sufficient thermit to make just one weld, luting sand and a small metal disc to keep the molten thermit from flowing prematurely into the gap between the bar ends.

Heavily coated electrodes containing large quantities of powdered metal in their coatings are increasing welding speeds. An article on page 56 of this issue gives a round-up of information from the several manufacturers who are now offering "powdered-metal" electrodes.

A portable automatic welding machine (see page 62, this issue) applies the Mig or metal inert-gas welding process to aluminum pipelines. In a trial run, this equipment performed so rapidly that it passed ditching machines and worked ahead of them. It is even claimed that it may make aluminum pipelines competitive with steel pipelines in cost.

Another development in Mig welding is a selenium-rectifier welder (p. 74, February, WELDING ENGINEER). This is said to maintain stable welding regardless of arc variations.

RESISTANCE AND GAS

Water-cooled ignitron tubes (p. 57, December, 1953, WELDING ENGINEER) represent the first major improvement to be made in well over ten years to the heavy-duty switches that make electronic control of resistance welders possible.

A spot-weld indicator (p. 57, March, WELDING ENGINEER) continuously indicates the exact location of spot welds by a small spotlight. The spotlight, which is magnetically anchored to the welder frame, makes it much easier to maintain equally spaced spot welds.

Apparently oxyacetylene welding is now as perfect as it can be, for WELDING ENGINEER could find no improvements this year to the process. In a closely related field, however, a very neat idea was originated. Flame-cutting and flame-hardening are combined in a single operation (pp. 54-55, April WELDING ENGINEER) in a machine for flame-machining precision gears from blanks. The surfaces are hardened as the gear teeth are being flame-cut.

Mechanized flame-scarfing is helping to reduce the cost and better the product of the steel industry. Newest machine (pp. 36-38 September, WELDING ENGINEER) scarfs four sides of a slab in a single operation to put it in proper condition for the rolling mills.

It has long been a practice to hardface tractor drive rolls and idler rolls with automatic welding equipment. Now the tracks, too, can be mechanically hardfaced by a new machine (p. 56, August, WELDING ENGINEER). It can weld anywhere from 1 to 100 inches per minute and can also be used to make longitudinal pipe welds or weld long seams in I-beams and other structural sections.

A new paste (p. 66, August, WELDING ENGINEER) is said to make hardfacing easier on thin blades such as plowshares, disc blades, etc. The paste is spread on by a spatula or a putty knife and bonded by an oxyacetylene torch or a carbon arc.

To eliminate waste from bent ends and tangling, preformed brazing rings are being offered to the user neatly fitted on a cardboard tube or dowel rod (p. 65, January, WELDING ENGINEER).

WELD INSPECTION

In the field of non-destructive weld inspection, a Van de Graaf generator, a tool long known to atom-smashing physicists, has been applied to an X-ray tube (p. 5, January, WELDING ENGINEER). The 2,000,000-volt potential is built by hauling up electric charges on a rapidly moving endless belt. The numerous small charges are continuously transferred into an insulated hemisphere that discharges into the X-ray tube. This interesting

WAXLESS thermit welding avoids the need for preheating to melt out wax

ABRASIVE leaves do the grinding

installation is at the Foster Wheeler Corp. plant at Mountaintop, Pa.

Irregularly shaped parts may be held for X-ray inspection by means of a plastic holder resembling a hot-water bag (p. 72, May, WELDING ENGINEER). The bag is filled with fine plastic granules. Normally, the bag is pliable like putty and can easily be molded to any desired shape. But when the air is exhausted by means of a vacuum pump, the bag and its plastic contents "freeze" and will hold the previously molded shape until air is allowed to re-enter. This device is being used at Solar Aircraft, Des Moines, to hold welded parts or castings during X-raying and to support the film during exposure.

New radioactive isotopes, which are relatively inexpensive as compared to radium, are competing actively with X-ray tubes in the nondestructive test field. The article in this issue by Dr. P. J. Stewart (p. 40) gives details on how cobalt-60 and iridium-192 are being used for the field inspection of gas storage spheres and other types of welded pressure vessels. The iridium isotope has an effective range of from ⅛ to 3 in. of steel thickness, and the cobalt isotope (which takes up where iridium leaves off) has a range of from 2 to 5 in.

A Johnny-come-lately to the fraternity of isotope inspectors is thulium-170 (p. 6, August, WELDING ENGINEER). Thulium (element 69) is one of the rarest of the rare earths. It is irradiated in the materials-testing reactor, then inserted within an aluminum capsule that fits inside a lead shield. A photographic cable release controls source position inside the shield and moves the source to the proper exposure position. When the source decays (half life is 129 days), it can be sent back to the laboratory to be reactivated. Thulium radiations are said to be most useful in the range of thickness up to 1 in. for steel or 3 in. for aluminum. Radiographs of very thin sections are deficient in contrast.

GRINDING AND POSITIONING

A flexible grinding wheel (p. 56, March, WELDING ENGINEER) is made from hundreds of leaves of abrasive cloth. Each of these individual leaves is sealed to a hard core, from which core the leaves radiate. The wheel thus formed is 6½ in. in diameter, 1 in. wide and can be attached to any rotating spindle.

Another grinding improvement is a non-clogging open-mesh abrasive (p. 80, May, WELDING ENGINEER). Resembling a window screen in its porous construction, this abrasive sheet is coated on both sides with silicon-carbide grain. It comes in grit sizes of 180 and finer.

An interesting innovation in welding positioners is one with a hollow kingpin (p. 76, WELDING ENGINEER, May, 1954). All lines are brought up through the center of the table and remain together, enabling the operator to position a weldment quickly and efficiently. Danger of broken hoses or tangled cables is minimized.

An ingenious tailor-made device (p. 44, January, WELDING ENGINEER) does precision pipe cutting at a large midwestern oil refinery. It makes straight cut-offs at any desired bevel angle or cuts and bevels the pipe for T-joints and even more complicated intersections. By changing cams on the machine, the holes are cut automatically to proper contour for any T-joint or pipe angle connection.

A pipe-cutting and beveling machine 40% lighter in weight is offered for large-diameter pipe (p. 57, January, WELDING ENGINEER). Three models cover a range of pipe diameters.

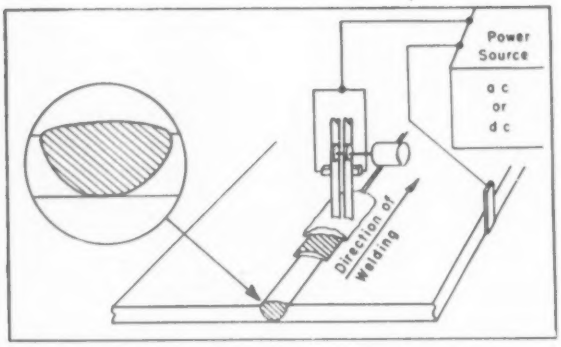
A new type of microscope reader assures more accurate readings of Brinell hardness (p. 64, January, WELDING ENGINEER). The image of a wire network, illuminated by a concentrated beam of light, is superimposed upon the image of the indentation made by the Brinell hardness tester. The scale is calibrated in millimeters and tenths of millimeters.

To judge from the developments of the past few months, the welding industry is striding ahead at a very good rate. Some of the inventions noted in this review may appear to be trivial. To which contention, we can only cite the words of a still renowned genius*:

"Trifles make perfection, and perfection is no trifle."

*Michelangelo (1475-1564).

New ways of automatic arc welding



1—PARALLEL circuit for submerged-arc welding is simplest arrangement, requiring only one welding head

To meet demands for speed and yet more speed, innovations have been introduced to submerged-arc welding. You can use more than one electrode, with advantages as here described. And you can oscillate the electrodes to get wider beads for surfacing applications.

BY T. B. JEFFERSON

AUTOMATIC submerged-arc welding has been able to increase speeds by as much as 400% as compared to manual welding. Even this does not seem to be fast enough for some fabricators. To meet their demands, submerged-arc equipment has been modified and improved to produce ever greater welding speeds.

EXTRA WIRE, EXTRA SPEED

One way to speed up submerged-arc welding is to feed more wire into the weld puddle. If you want more metal, you can use wire of a larger diameter, but there are limits to what may be accomplished along this line. The newer way is to use more electrodes.

Equipment has now been developed to permit two, three or even four electrodes to be concentrated in the same weld puddle. By this arrangement, extra-high welding speeds can be attained. In fact, some users claim increased speeds up to 50% over single-electrode submerged-arc welding — without sacrifice of quality or penetration.

Multiple-electrode submerged-arc welding may be used for any application in which single-electrode submerged-arc welding is being done today. It is found advantageous, just as in single-electrode operation to position the work so that all welding will be done in the flat position.

Sometimes it will be found necessary to install additional power sources in order to take full advantage of the gains made possible by multiple-electrode welding. On other applications, the present welding transformer (or generator) will render satisfactory service. In these cases, multiple-electrode welding may be done by making a few changes to existing single-electrode equipment. For example, if welding is to be done with two electrodes, the standard welding head must be converted by making the following additions:

1. Install a second drive roll.
2. Install a new idling roll to give uniform pressure to the two electrodes.
3. Install new guide tubes to guide two electrodes to and from the drive rolls.
4. Install a nozzle with double contacts so that current may be uniformly fed to both electrodes. This nozzle must be made so it may be set at different angles with respect to the weld groove.
5. Install a second electrode reel.

The changes and additions become quite complicated when more than two electrodes are used, and it is best to let the experts discuss them.

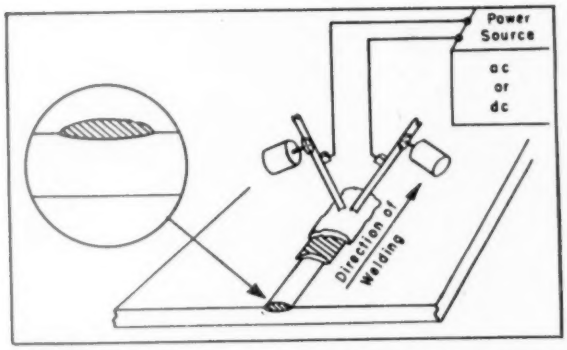
SERIES OR PARALLEL?

Assuming that a single power source is to be used, either a-c or d-c, there are two ways in which welding current may be fed to the electrodes, or, if you like the terminology better, two hook-ups for the welding circuit. The electrodes may be connected either in parallel or in series.

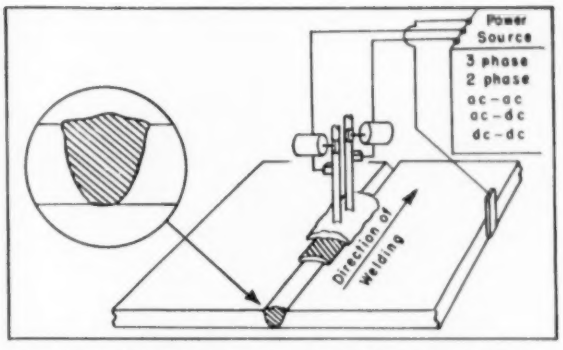
The parallel circuit arrangement is the more conventional. Here one power supply cable is connected to both electrodes, while the other lead is grounded to the work, Fig. 1. This provides the simplest double-electrode arrangement. Only one welding head is required, and a single-arc unit can be easily converted.

In the parallel circuit hook-up, a single voltage control governs the welding head, which feeds both electrodes at once. Since the current is divided between the two electrodes, current densities are reduced; hence penetration will not be as great as for a single arc at the same current rating. The parallel system offers the advantage, however, of making a wide bead on joints involving poor fit-up. To do this, the electrodes must be in a side-by-side position.

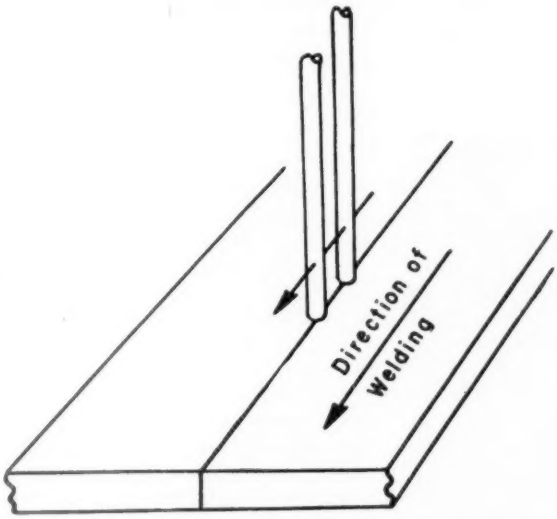
To connect the two electrodes in series, two welding heads must be used, Fig. 2. Usually a single power source is sufficient, though power units may be banked to obtain higher welding currents. The hook-up is simplicity itself. One power-supply lead is connected to one welding head. The other power cable, normally the ground lead, is connected to the other welding head. During welding, the current travels between the two electrodes by passing through the base metal and weld puddle. But most of the current is used to melt the elec-



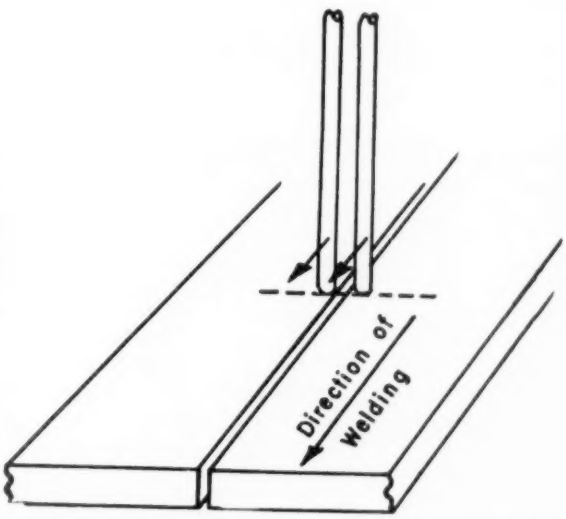
2—SERIES circuit needs two welding heads, each of which is connected to one of the power-supply leads



3—MULTIPOWER circuit: each welding head has its own power source; one side of the circuit is to ground



4—TANDEM electrode arrangement. One leading and one trailing electrode, both in line with weld groove



5—SIDE-BY-SIDE position. Electrodes straddle the groove on an axis that is at right angles to it

trodes, and very little enters the base metal.

For series welding, the electrodes are usually in a side-by-side position. This produces a broad, shallow deposit—ideal for surfacing applications.

Multiple Power Sources

Where a single power source is inadequate, a multipower system is used, Fig. 3. In this arrangement, each electrode has its own power supply, welding head and voltage control, but one side of the power circuit is to ground, as in convertional welding. Any combination of d-c, a-c, two-phase or three-phase power may be used.

This method of welding gives high speeds and results in narrow, deeply penetrating deposits. It is excellent for such jobs as welding thick plate with prepared edges. On the disadvantage side, it calls for expensive power equipment.

Electrode Positions

In multiple-electrode submerged-arc welding, the two electrodes may be placed at any angle with respect to the welding groove. Normally, however, only three positions are used, to be noted in the next paragraph. The electrodes are usually held perpendicular to the plate; however, satisfactory welds have been made with the forward electrode tipped as much as 60° from the vertical.

The three electrode positions are:

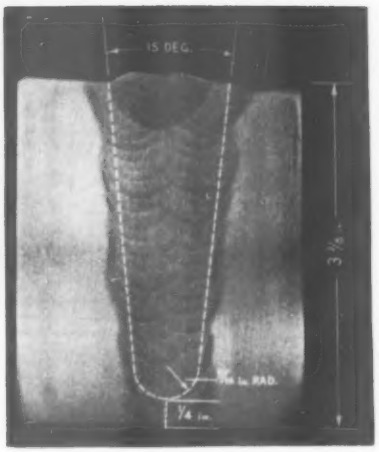
(1) Tandem (Fig. 4). Here one electrode is behind the other and both are in line with the weld groove.

(2) Side-by-side (Fig. 5). The two electrodes straddle and are at 90° to the groove.

(3) Skewed (not illustrated). The skewed classification includes all positions where the two electrodes form an angle with the welding groove that is not 0 or 90°. However, the angle is seldom more than 10° either side of the tandem position.

Of the three basic positions, the tandem arrangement produces maximum penetration, more uniform bead edges and highest travel speed. If a wide bead is desired with small electrodes such as 5/64 or 3/32 in., skewed welding is sometimes advantageous. It results in a slightly wider bead than a tandem set-up, but will give approximately the same penetration. In the skewed position, however, the trailing electrode has a tendency

6—FILLET welds have 7/8-in. legs and were made on 3/4-in. positioned plates. Electrodes were side-by-side. Welding was done at speed of 15 ipm



7—ABOUT 40 passes on 3⅜-in. butt weld. Electrodes were tandem

to undercut on its side of the groove. Slower travel speeds will eliminate this fault.

In skewed welding, it is advantageous to place the front or leading electrode over the weld groove because the second arc is attracted to the hot weld deposit. This arrangement will make the center of the weld bead nearly in line with the front electrode.

Side-by-side welding has two principal uses: *(a)* For hardfacing where a minimum penetration and wide, flat beads are required, and *(b)* for poor fit-up joints with widely spaced edges. In the latter application *(b)*, the arcs are directed on both sides of the groove rather than in the center as in single-arc welding. With the arc spread over the whole bead width, penetration is decreased and the tendency to burn-through is minimized.

In poor fit-up applications, precautions should be taken to prevent the molten metal and flux from running through the gap. If the gap is wide, the current must be high, or the speeds low. High current, slow speed will permit sufficient weld metal to be deposited to fill the gap.

How Far Apart?

In any of these electrode arrangements, the electrodes are generally kept close together within fairly narrow limits—from 3/8 to 5/8 in. There are very good reasons for using a narrow spacing.

In tandem welding, a narrow spacing produces a more stable arc and uniform bead. However, welding current must be low and travel speed high. If current is increased and speed decreased, a wider space between the electrodes is required. Wider spacing will result in better penetration for a given current setting and speed within a limited area. It is easy to increase the spacing too much, however, so that the arc becomes unstable and poor bead edges result.

In side-by-side welding, a narrow electrode spacing is used for both high and low currents. A wide spacing (unless the speed is very slow) will reduce penetration materially. It is possible (though not desirable) to deposit two parallel beads if the electrodes are far apart and the travel speed fast.

Let's now look at some particular applications. Photo 6 shows positioned fillet welds on 3/4-in. plate. The fillets have 7/8-in. legs. The welds were made at a speed of 15 ipm, and the two 1/8-in. electrodes were side-by-side and spaced 1/2 in. apart. A d-c power source was used, and the current setting was 1,500 amps, 35 volts.

Butt welding of plate is usually done by parallel or by multipower circuits. The shallow-penetration characteristic of the series circuit makes it unsatisfactory for butt welds in heavy plate. Series welding, however, may be used for butt welding sheets too thin for single-electric welding or for joining sheets in cases where it is impossible to provide adequate back-up. Both of these applications require a tandem electrode set-up.

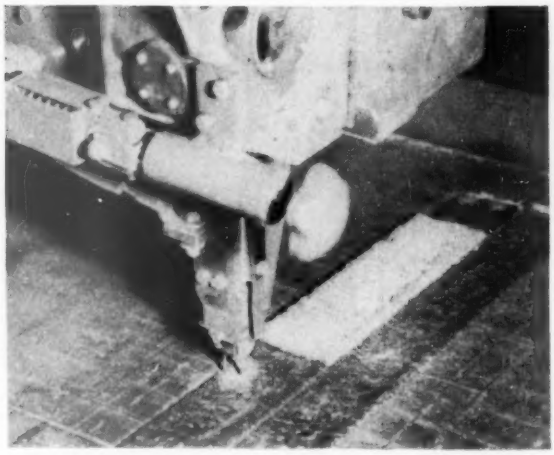
The parallel circuit system is limited in butt welding to 5/8-in. plates. This thickness is about the limit that may be welded in one pass on each side of the plate. With suitable edge preparation and by slowing down welding speed sufficiently, it may be possible to weld plates 1½ in. thick. However, a multipower system is preferable for heavy plate work.

For extra-thick, deep-groove welds that must be made in several passes, a multipower system works best. Even when the individual passes deposit no more metal than a single electrode, the speed will be higher. As an example, it is possible to weld with two electrodes at 30-50 ipm as compared to 8-10 ipm for single-electrode welding. An example of the welds produced in the multipass joining of 3⅜-in. plate is shown in photo 7. About 40 passes were made, using tandem electrodes and a multipower source.

Hardfacing Applications

Hardfacing often requires the deposition of a wide bead that will not penetrate deeply and so become diluted by the parent metal. For a wide, shallow bead, a series circuit is the type to use. The height and width of the deposit may be determined by the height and location of the electrodes above the work. For such an application, the electrodes are always positioned side-by-side. A wider bead is sometimes obtained, however, by pointing the electrodes at each other at an angle of 45°.

Either an a-c or d-c power source is satisfactory for surfacing appli-



8—TWO side-by-side electrodes on new swinging device deposit a bead of hardfacing that is 3½ in. wide

9—SWINGING device was used again on this dipper tooth to make a 3-in. single-pass hardfacing deposit

cations. It has been found that a-c seems to work best with mild steel and stainless, while d-c is better for the non-ferrous materials. Furthermore, there is a tendency with d-c series welding toward slightly deeper penetration under the positive electrode.

Oscillating the Arc

A recently developed attachment permits the electrodes to be oscillated back and forth across the seam, that is, perpendicular to the direction of travel. The back-and-forth swing will materially increase the width of the deposited bead. As an example, photo 8 shows a hardfacing bead 3½ in. wide that was deposited by two side-by-side, swinging electrodes. The two ⅛-in. electrodes were spaced ⅝ in. apart, and they swung back and forth 18 to 20 times a minute in a direction perpendicular to the weld. Welding conditions were: speed 5 ipm; current 800 amp; 35 volts; d-c, straight polarity. Use of the oscillating device is confined to mild-steel electrodes and an agglomerated flux.

This same equipment was used to deposit a hardfacing bead on the tip of a dipper tooth. The entire face of the tooth was covered in one pass by the 3-in. bead, photo 9, using 22 oscillations per minute. The two ⅛-in. electrodes were in side-by-side position and spaced ⅝ in. apart. Welding conditions: speed 5 ipm; current 700 amp; 32 volts; d-c, straight polarity.

In photo 10, the same type of welding is being done to build up pads on the track of a 2½-yard shovel. The pads are 2 in. wide—easily within the scope of the oscillating electrodes.

10—TRACK of a 2½-cu-yd shovel is receiving hardfaced pads 2 in. wide

Wherever surfaces are to be built up by automatic welding, multiple-electrode submerged-arc welding will be found capable of doing the job better. Applications need not be confined to the deposition of hardfacing materials; stainless steel, too, may be readily deposited by this process. Large areas may even be built up by using mild-steel electrodes.

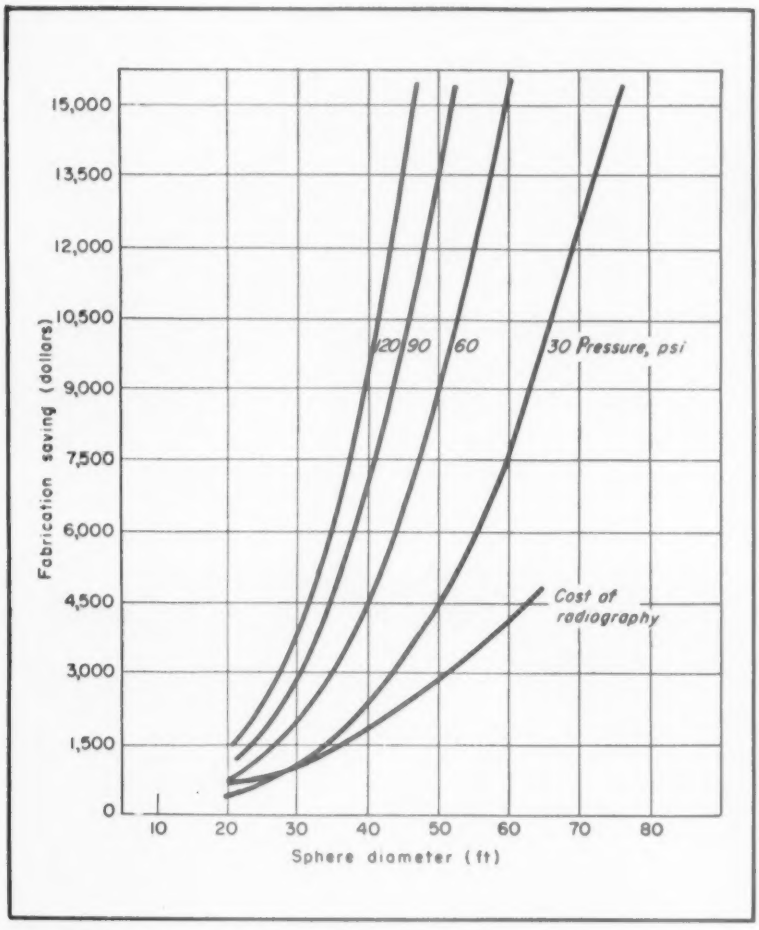
A major advantage of multiple-electrode submerged-arc welding is the ease with which the dilution of the weld metal may be controlled. The latter feature is an important consideration in hardfacing and cladding.

Speed is another advantage. A multiple-electrode set-up is always at least 50% faster than single-electrode welding and, depending upon the arrangement of the electrodes, may be as much as 200% faster.

The use of oscillating multiple electrodes is so new that the possibilities have scarcely been touched. Present applications will undoubtedly lead to many more developments to bring about other innovations, needed to keep pace with the growing uses of the welding processes.

* * *

Acknowledgment for illustrations: drawings 1, 2, 3, 4 and 5 and photo 7 are reproduced through the courtesy of Linde Air Products Co. Photos 6, 8, 9 and 10 were furnished by The Lincoln Electric Co.



1—HOW radiography reduces fabrication costs (see explanation in text)

2—FILM strips attached when a 54-ft welded sphere is under snow

3—HOW film strips are fastened

New isotopes aid radiography

BY DR. P. J. STEWART
Isotope Products Ltd., Oakville, Ontario

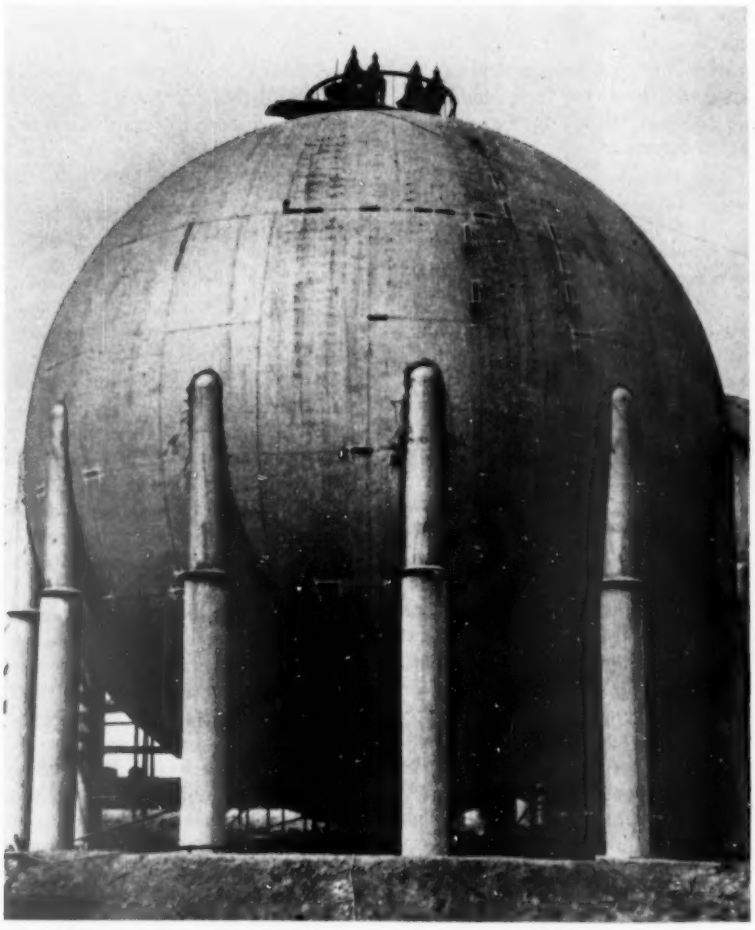
DR. P. J. STEWART is supervisor of inspection services at Isotope Products Limited. This Canadian company, founded in 1950, has specialized in industrial applications of radioactive materials. Among the first to develop iridium-192 for the field inspection of welding, Isotope Products now operates a gamma radiography service from four Canadian branches and two affiliates in the United States at Buffalo and at Houston.

DURING the last few years, field inspection of welding has been carried a large step forward by the advent of radioactive isotopes. The new techniques enable radiographic inspection to be carried out more cheaply and in locations unknown before. In particular, the oil and chemical industries are benefitting.

What is the value of weld inspection on these units? The first, most obvious answer is that inspection is a form of insurance against failure. There is no doubt that the failure rate in oil storage tanks is very high, and no type of insurance now written guards against tank collapse. It has been reckoned that failures average $400 per tank for the shell alone, not including contents.

There is a further economic justification for weld inspection. The strength of a welded joint is expressed in terms of percentage efficiency, which represents the ratio of the strength of the weld to the strength of the plate. Now the percentage efficiency that is allowed for any welded joint depends upon the inspection it has received. To take an instance of this, in the ASME Code for Unfired Pressure Vessels we find that a weld efficiency of 80% is allowed for a normal double-welded butt joint. If the same type of joint is radiographed, however, an efficiency of 90% is allowed.

A low percentage of efficiency means that the weld and the surrounding plate have to be increased in thickness. An improvement in efficiency can result in a decrease of the



4—SPOTTY film strips on sphere are for radiographing rewelded sections

# of spheres and tanks

plate thickness throughout the vessel. In almost all cases, the weight of the steel thus saved will more than pay for the cost of radiographic inspection—especially since the use of radioactive isotopes has reduced inspection costs so markedly.

The chart (Fig. 1) shows some of these savings graphically for pressure spheres. All welds are radiographed according to API-ASME specifications for pressure vessels. The weld efficiency is thereby raised from 80% to 90%, allowing the plate thickness to be reduced by 12½%. There is also a saving of over 25% in the labor and cost associated with welding. The latter saving comes from geometry; *i.e.*, if one reduces the height of a bevel or welding vee (by reducing the plate thickness) by 12½%, the volume to be filled with weld metal is reduced by 25%.

Up to six times the cost of the inspection can be saved, $10,000 or more on the larger spheres.

These savings have been realized only with radioactive isotopes, which have simplified so greatly the methods of field weld inspection. Several isotopes have been proposed, and three actually used.

Iridium and Cobalt

Of these three, iridium-192 has all the advantages. It is an artificial radioactive material, made in atomic reactors. A tiny piece, generally only a millimeter or two in diameter, of the hard, silvery iridium metal is sealed in a light-metal capsule. It is inserted into the atomic furnace and left there to be "cooked" anywhere from two weeks to several months, depending on the strength of source needed. During the cooking period, the iridium picks up extra neutrons from those present inside the rector and is transformed into a radioactive isotope.

Like radium, iridium-192 gives off a radiation, quite similar to X-rays, called gamma rays. Though invisible, these rays resemble visible light rays in that they will affect a photographic film. Just as light rays can penetrate glass, so gamma rays can penetrate steel and other metals. In fact, gamma rays will penetrate any solid substance, to a greater or lesser extent.

The gamma rays from the iridium isotope are actually among the least penetrating. Even so, they have an effective range for radiographic purposes of 3 in. of steel and so are equivalent to the rays from some of the more powerful industrial X-ray units. Cobalt-60, the radioactive material most in the news, gives off more penetrating gamma rays, which take over where iridium leaves off. They produce good radiographs in from 2 up to 5 in. of steel. However, such penetration is not very often necessary for weld inspection. The large majority of structural welding, and all platework, falls in the range from ⅛ to 3 in., for which iridium gives the best results.

Radioactive materials have been accused of two disadvantages for industrial radiography: (1) too slow and (2) radiographs show too little contrast. The use of iridium-192 has remedied both of these charges.

Sources Are Now Larger

To meet objection number 1, iridium-192 has made much larger sources of radioactivity available. When only radium was available for gamma radiography, the average size of a capsule was about half a curie.* Iridium sources are now being used up to 50 curies. Naturally, a hundredfold increase in source strength is able to effect a corresponding reduction in exposure time. A great reduction in costs has also been effected. Whereas half a curie of radium costs $10,000, 50 curies of iridium-192 costs about $700.

To meet objection number 2, iridium gamma rays are among the least penetrating. This fact is responsible

*A "curie" is a unit of radioactivity, named after the discoverer of radium.

for a high contrast on radiographic pictures. The low penetration has the further advantage of making the handling of the radioactive isotope much easier since less lead is required for shielding the gamma rays. Whereas the safe handling of half a curie of radium requires a 200-lb container, 50 curies of iridium can be handled in a 60-lb container.

Generally speaking, lead "exposure cameras" of various designs are used for tanks and spheres. They handle from 5-curie up to 20-curie iridium sources, weigh from 25 to 50 lb and can easily be transported by one man.

Film for this kind of work is generally in the form of long strips. On oil storage tanks, where 8-ft and 6-ft seams are shot, two overlapping film strips are sometimes used, but more often there is only one strip. The film strips are attached to the welds by an industrial tape. A number of different tapes were tested before one was found that is able to withstand the variety of environmental conditions: heat, cold, wet, rust and oil.

In Snow or Sun

Film has been attached to spheres under weather conditions varying from a blazing sun to a blizzard at zero temperature. Photo 2 shows a 54-ft sphere under snow with film strip attached, ready for inspection at Imperial Oil's Sarnia refinery. In photo 3, we see a film strip being attached to a 48-ft sphere and in the large picture (photo 4) repaired sections are being shot on a 54-ft sphere.

The film is a normal, medium-grain type of direct X-ray film, generally 70 mm wide. In front and back of the film, lead intensifying screens of 10-thou-thick lead foil are placed to speed up the exposure and produce sharper pictures. The screens are mounted on semistiff plastic to reduce pressure marks, which might be caused by rough spots on the weld pressing against the film (sphere and tank field welds are not generally ground before radiographic inspection).

The screens and film are enclosed in a long, plastic holder, which is closed by a plastic zipper to make a lightproof and waterproof case. Each holder is marked with tank and seam identification numbers, and lead markers are placed at 1-ft intervals along the seam to assist in the exact location of defects.

In isotope tank and sphere inspection, two broad methods are available: one-shot and multishot radiography. In the multishot method, the seams are inspected individually; in the one-shot method they are inspected all together.

The individual shooting of seams has a big advantage during the first stages of construction: the welds can be radiographed shorty after they have been completed in order to check the work of individual weldors. Once satisfactory results are being obtained from all operators, however, it is more economical to check the vessels in larger units—one or two courses at a time on oil storage tanks or the complete sphere at once in the case of spheres.

How Spheres Are Inspected

All the plate on a sphere is usually of the same thickness, and it is the nature of a sphere that any point on its surface (inside or outside) is at the same distance from the center. Hence a single iridium source at the center will give a uniform exposure for the seams of the entire sphere. The source capsule is carried to the top of the sphere in a lead container and lowered into the sphere through the top manhole on a chain. For sphere inspection, 6 to 15 curies of iridium are generally used.

As many as 2,000 ft of film have been exposed in a single shot on a 50-ft diameter sphere. Nozzle welds, manholes, plate coupons, welds with backing strips, etc. can all be included in the single inspection. On a 50-ft sphere, the radiography crew will take one or two days to put on the film strips, two or three hours to strip them off after exposure. The exposure required is usually arranged to be 15 hours—an overnight exposure. The complete inspection, including the interpretation of the 2,000 ft of film strip, takes about nine days.

Test films are often removed and developed periodically, and the gamma-ray strength at the film is also measured by instruments. Under inspection conditions, the outside of the sphere can be approached with perfect safety while the exposure is on. And, of course, no residual radiation of any kind will remain when the exposure is over.

Cylindrical Tanks

Cylindrical storage tanks present a more difficult inspection problem. A cylinder is not like a sphere; it is not possible to position the source so all the welds will be at a uniform distance. Also the weld thickness, which determines the exposure time, will vary from bottom to top of the tank. For these reasons, it is generally better to shoot only one course, or at the most two courses, at a time. In this case, there will be only one plate thickness to contend with and the film-to-source distance will not vary by a great deal along seams.

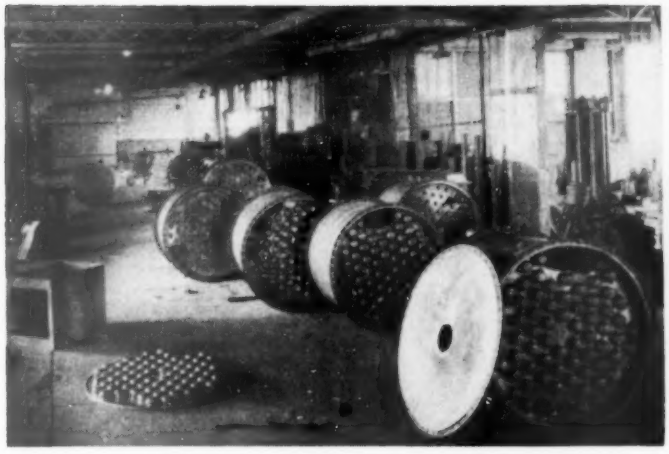
In the largest oil storage tanks, the source-film distance may be 80 ft—a much greater distance than anyone could have thought possible until recently. To obtain a 15-hr exposure at such a distance, powerful sources of around 60 curies of iridium-192 are used. The source is generally located by means of a rope stretched across a diameter of the tank. The rope carries a pulley block at the center so that the source can be raised from a shielded container to any desired height by an operator who is working at a safe distance.

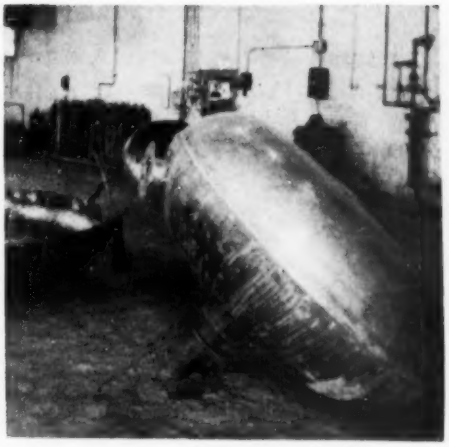
For multishot work, it is almost always possible to work from the welding scaffold unless automatic welding was done on the girth seams. In the latter case, special, self-supporting "exposure cameras" have to be used.

The multishot method is satisfactory for oil storage tanks under conconstruction, but completed tanks, in which supporting pillars are erected, are another story. Luckily, the very large source-to-film distance means that a comparatively large (physical size) iridium source can be tolerated without affecting the sharpness of the radiographic picture. For such tanks, up to four separate sources have been employed, these being spaced around the central pier so that every weld is "under fire" from three sources.

When radiography is combined with a control system to bring faults to the attention of the individual weldors responsible for them, a marked improvement in welding quality has been achieved. As an example, on one recent tank construction project, 10% of the welded seams had to be repaired on the first tank erected. By the fifth tank, only one small spot of a few inches in the whole tank necessitated rewelding.

The achievement of boiler-code-quality welding in field-erected vessels has become a practical possibility with the assistance of gamma radiography.





ON JOBS like these can we use . . .

Nitrogen for Tig welding?

Will nitrogen replace argon and helium in Mig and Tig welding? Reports from overseas experimenters indicate that this cheap gas may be suitable for welding copper and other metals. A 30 to 60% saving could result.

BY T. B. JEFFERSON

PRINCIPAL obstacle in the path of inert-gas welding is the fact that the supplies of inert gases are definitely limited. Though helium is the second most abundant element in the Universe, here on Earth it is not found in any large quantities. An actual shortage is anticipated by the U. S. Bureau of Mines, which controls the principal supplies of helium in the United States.* Argon can be extracted from the atmosphere, but it is present in only 1% by volume. If Mig and Tig welding are to continue to flourish, it would seem most desirable that less rare shielding gases be found.

Nitrogen is a fairly inert gas (though not in the same category as helium and argon), and it is found in abundance. Around 78% of our atmosphere consists of nitrogen. In Europe and in Russia, where helium is not available and argon is quite expensive, Tig and Mig welding experiments have been carried on using nitrogen as a shielding gas.

The nitrogen employed for such experiments is a commercial grade, free of oxygen and moisture. It would be interesting to know whether a less pure nitrogen, or moisture in the gas, will interfere with shielding properties, but experiments have not been carried on to a sufficient degree to determine this. Neither have the experiments been carried on far enough to determine what metals may or may not be welded with a nitrogen shielding gas. To date, most of the nitrogen welding has been confined to deoxidized copper.

Not for Steel

It seems most unlikely, though, that mild steel will ever be commercially Tig welded with a nitrogen shielding gas†. Reason: nitrogen is readily soluble in steel at welding temperatures and definitely gives rise to aging effects. In steelmaking, the aging effects of nitrogen are avoided by the additions of strong deoxidizers. Their purpose is to "fix" the oxygen so that it can no longer give rise to precipitation-aging effects by going in and out of solution. However, the same deoxidizers also fix the small percentages of nitrogen dissolved in low-carbon steels in the same way.

Such deoxidizers are not present when Tig welding is done with nitrogen shielding. As a result, welds in low-carbon steels are quick to show the aging characteristics of increased hardness and tensile strength, lowered ductility and impact strength and a sharply defined yield point after cold working or quenching.

Experimental Tig welds have been made on low-carbon steel with a nitrogen-helium mixture as a shielding gas. These experiments were conducted at the Buick-Oldsmobile-Pontiac Division of General Motors, Kansas City, Kansas (1). They indicate that a nitrogen-helium mixture produces better results at lower cost than an argon-helium mixture.

It would seem reasonable that the metals in which nitrogen gas could be used effectively as a shield are the metals in which nitrogen is insoluble up to fairly high temperatures. Copper is such a metal. The problem is complicated, however, by oxygen, for which copper has an affinity at high temperature. Hence only the high-purity types—deoxidized copper, oxygen-free copper and electrolytic tough-

PICTURES SHOW

LEFT: Nitrogen-shielded Tig welding could be used to fabricate such products as these fractionating columns for methyl alcohol recovery

RIGHT: Large copper kettles for brewing and chemical industries are other items that might be fabricated by nitrogen-shielded Tig welding

*Welding Engineer, Dec. 1953, page 89.

†Some laboratory experiments have been carried out with a fair degree of success.

How Characteristics of Three Gases Compare

	Specific Gravity Air = 1.00	Cu ft/lb	Specific Heat Cal/g/C	Thermal Conductivity $Cal/cm^2/cmC/sec$
Helium	0.1386	80.83	1.25	3.32×10^{-4}
Argon	1.376	9.021	6.7	0.406×10^{-4}
Nitrogen	0.9673	12.572	6.2	0.000060

pitch copper—are suitable, though it may prove possible to weld some of the brasses and bronzes without forming harmful nitrides.

Lead, tin and zinc can probably be Tig welded with nitrogen as a shielding gas since nitrogen is insoluble in these metals until they are heated to a temperature ranging from 1,100-1,500 F, which is well above their welding heats.

Most of the nitrogen-shielded welding has to date been done in deoxidized copper in plate thicknesses of ½ in. or less. The filler rod was generally silicon bronze with 3% Si. 1% Mn, though some work has been done with a 1% silicon rod or a 1% titanium or a 2% titanium, 1% aluminum filler rod.

Argon vs. Nitrogen

Because argon is expensive in Europe, its use cannot be justified by the time saved in postweld cleaning, as for instance in the welding of aluminum. Even in Europe, however, it is advantageous to use Mig or Tig welding, which make possible high-speed welds of good quality even though the weldors are not the most skilled. Hence the search for a less expensive inert gas for welding.

Since argon is about nine times as heavy as helium and 30% heavier than nitrogen, its greater density cuts down its rate of diffusion with the air. Likewise, the heavier gas reduces the amount of cylinder handling and space required for cylinder storage.

Some of the important characteristics of these three gasses are given in the table at top of page 44.

In d-c Tig welding with a pure tungsten electrode, there is a tendency for the arc to blow. The arc will wander around the electrode tip until the welding current is sufficiently high to make the entire end of the electrode molten, at which time there seems to be no particular hot spot on which the welding current can concentrate. The blowing is greatest when the ratio of arc current to the current-carrying capacity of the electrode is small. To avoid this difficulty, the welding current must be increased or an electrode of smaller diameter used, either of which will increase the ratio.

When the selected electrode is the correct size for the particular current range, a stable arc will be obtained. The strange feature is that further increases in welding current seemingly have no effect other than to melt the electrode. This, of course, is not desirable since tungsten metal will drip into the weld puddle.

Nitrogen, as an inert-gas shield, accentuates the tendencies to blow and to melt off the pure tungsten electrodes. Davis and Terry (2) found that tungsten was transferred in the arc at low currents and even when the molten globule on the electrode tip was small in relation to the cathode tip area. This condition prevailed when welding was done in vertical and overhead positions, proving that gravity played no part in the transfer.

In a-c Tig welding, it will be found that a pure tungsten electrode will display the same characteristics as described for d-c applications. The useful current range, however, is even smaller due to greater heat in the electrode. This results from the more even distribution of heat that is caused by alternating current. When current from an a-c power source is conducted through a pure tungsten electrode shielded with nitrogen, it looks like the Fourth of July. Davis and Terry (2) found that, even at low currents, the spatter was too severe to permit welding.

Hunting a New Electrode

In an attempt to overcome the poor welding characteristics with pure tungsten, these two British researchers experimented with the coating of Tig electrodes. Two types of coatings were first tried: barium carbonate with sodium silicate as a binder and zirconium oxide with sodium silicate. Both coatings materially improved the operating characteristics of the electrodes but burned off after a few minutes of welding. During their effective life, there was no tendency for the arc to wander nor was there a molten globule at the end of the electrode. The welding was done with d-c, straight polarity at low welding currents.

Spurred on by this partial success, Davis and Terry experimented further. They found that thoriated tungsten electrodes were the solution to their electrode problems. Containing 1% thoria, these electrodes, in ⅛-in. size, were stable up to 400 amp without a molten globule when welding was done with nitrogen shielding.

This characteristic of the thoriated tungsten electrode makes it possible to work with a pointed electrode without melting it so long as current values are kept within the conductivity limits of the electrode. This is equally true when argon or helium are used as shielding gases. In all cases, it will be found that the electrode will melt when welding currents become too high.

Higher arc voltages are required when nitrogen is used as a shield-

ing gas. The best range seems to be about 30% higher than would be used under the same circumstances with argon. However, the increased arc voltage is good: it results in more heat than would be obtained at the same current setting with argon. As the use of a nitrogen shield becomes more widespread, its higher arc voltage should also offer advantages in mechanized Tig or Mig welding where arc control equipment provides a constant predetermined arc length.

Nitrogen gas also gives indications of providing greater heat transfer efficiency. Like hydrogen, nitrogen is a diatomic gas. Diatomic gases, including both hydrogen and nitrogen, become completely disassociated in an arc atmosphere at arc temperatures. When single nitrogen atoms combine to re-form the diatomic gas molecules, heat is liberated in the arc atmosphere —a reaction similar to that which takes place in atomic-hydrogen welding. In both cases, the result is an increased heat-transfer efficiency, enabling arc temperature and voltage to be increased while the arc current is reduced.

While two to three times as much helium is used in comparison to argon, the lesser variation in densities only necessitates 20 to 50% nitrogen (3). For example, with a ⅛-in. electrode on ⅛-in. copper, a flow of 9 liters per minute (19 cu ft per hr) was satisfactory.

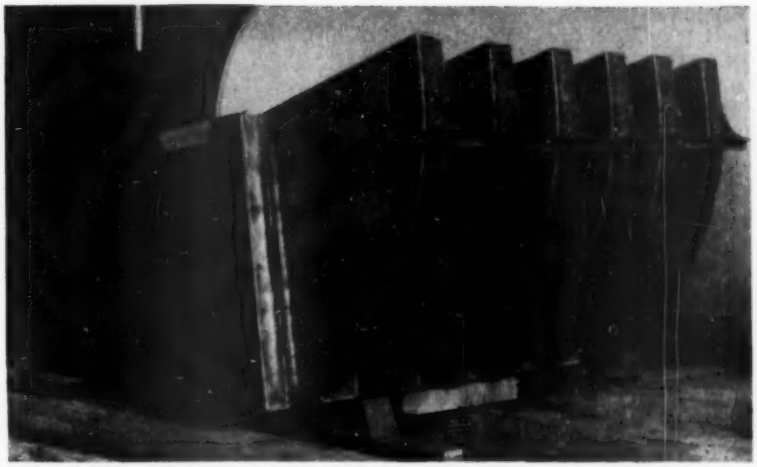
Welding Copper

For welding deoxidized copper up to 3/16 in. thick, very little preparation is required. Welding may be done without edge preparation other than cleaning. The edge of the joint should be degreased and then brightened to remove the oxide with either a wire brush or steel wool. Plates ¼ in. thick and up should be beveled—a single-vee bevel with an included angle of 60° to 80° has proved to be best. On ¼-in. plate, a 1/16-in. root opening is desirable. Above that thickness, use a ⅛-in. root opening.

Jigging is always desirable in welding cooper. In any event, welding should be done against a back up-bar. After welding, the root bead should be chipped out and a backing bead deposited.

Multiple-pass welding is also desirable. Davis and Terry (2) found that a heavy first pass was required. When a small bead was used on the first pass, there was a tendency for a longitudinal crack to develop. They also found that a backhand technique was bad on the first pass, especially with a silicon-bronze rod, since the rapidly melting rod had a tendency to flow into the groove ahead of the arc and thus give varying degrees of penetration along the weld. Davis and Terry (2) recommend a forehand technique on the first bead, then backhand on subsequent passes as well as on the backing bead. To provide uniform heat distribution, each pass should start at the same end. Should the forehand technique appear to be interfering with the gaseous shield, increase the flow of nitrogen and additional 25%.

It is well to back chip and run a backing bead. This will insure good root fusion, which may prove difficult to achieve otherwise. Back chipping should be done even when the weld is made in one pass on a 3/16-in. plate with square edges.



ROCKER is a liquor bed of deoxidized copper. It could have been fabricated by inert-gas welding, using nitrogen instead of helium or argon gas

Copper Fumes

Nitrogen and copper together are apt to result in heavy cuprous fumes. While there are no harmful effects, the fumes restrict vision, and severe undercutting may occur. A dust of copper and cupric oxide—a black powder—is also given off during welding. This dust has no effect on the fusion of the metal, but it does tend to make the weld puddle sluggish. Because of it, a nitrogen-shielded weld lacks the bright, clean appearance found in a weld shielded by argon or helium. The surface of the weld is also uneven.

Up to ¼-in. plate, a nitrogen-shielded weld may be controlled without difficulty; above that thickness, there is a likelihood of surface oxidation and a tendency toward lack of fusion unless extreme care is exercised.

Winterton (4) has found that the greater arc force of nitrogen results in wider deposits and slightly faster welding speeds. He also found that carbon electrodes will work satisfactorily when welding copper in a nitrogen atmosphere.

All experimenters are agreed that a filler rod of 3% silicon bronze produces the best results. Welds of this material approach the base metal in tensile strength but are somewhat less ductile, though capable of making a good bend test. When welds were tested to failure, the break generally occurred at the weld junction. Rods with 1% silicon or bronze rods deoxidized with other alloys than silicon resulted in welds that would often exhibit poor mechanical properties and localized porosity. They also had a tendency to crack at the line of fusion because of heat and shrinkage.

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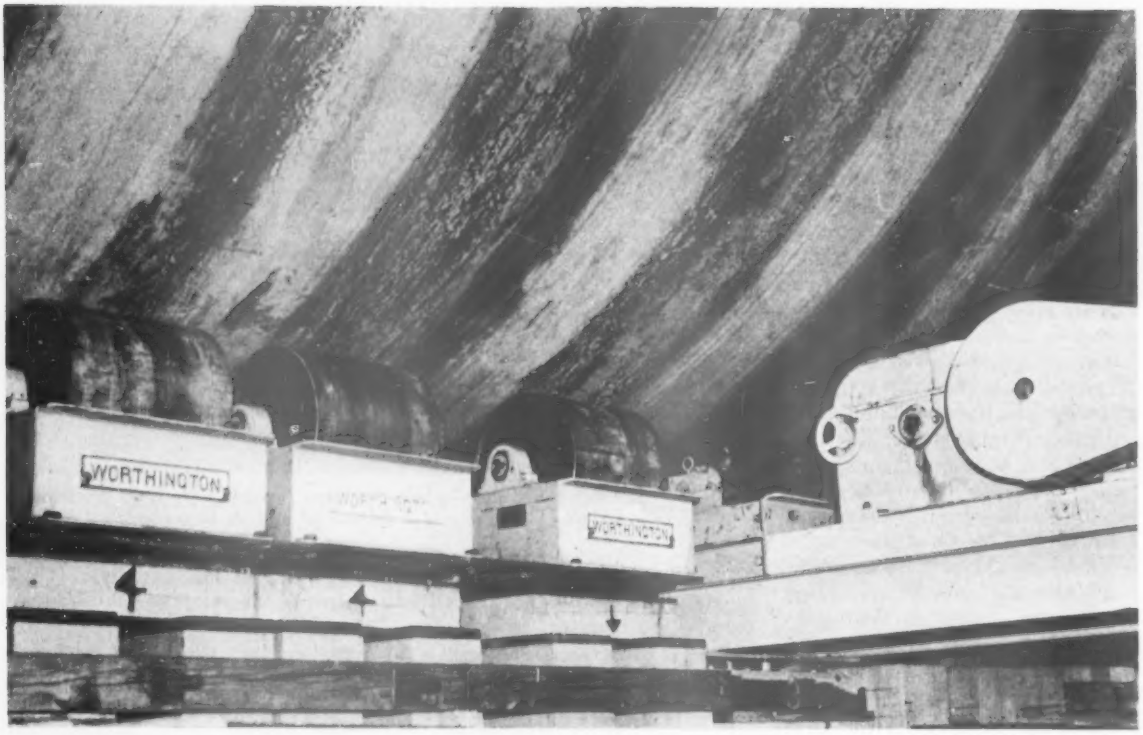
(2.) Edwin Davis and C. A. Terry: *British Welding Journal*, 1954, Vol. 1, pp 53-60.

(3.) A. N. Shashkov and T. S. Khromova: *Autog. Delo.*, 1950, Vol. 9 pp 4-7.

(4.) K. Winterton: *British Welding Journal*, 1954, Vol. 1, pp 87-90.

(5.) J. H. Cole: *Welding Research*, 1952, Vol. 6, pp 83r-86r.

(6.) J. H. Cole: Ibid, 1951, Vol. 5, pp 157r-162r.



New turning rolls help

BY HERMAN C. PHELPS

THE world's first atomic-powered submarine the SSN-571, better know as the *Nautilus*, is now moored to her outfitting dock at the Electric Boat Division of General Dynamics Corp., Groton, Conn., where the propulsion equipment is being installed. Her atomic power plant is being built by Westinghouse Corp. and will be partially furnished by the AEC.

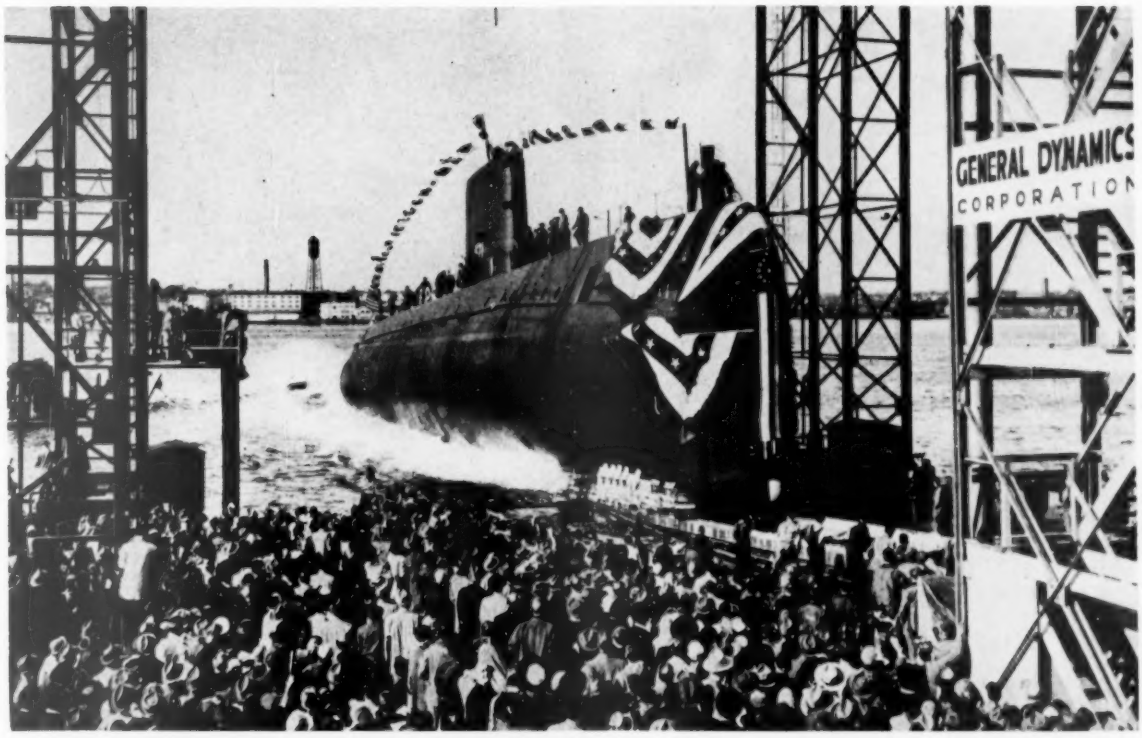
The new 300-ft-long denizen of the deep was christened in ceremonies at Groton by Mrs. Dwight D. Eisenhower. The submarine required 19 months to build, and every device known to welding was used to insure perfect metal joining. All butt joints were 100% radiographed.

FIRST lady of the land, Mrs. Dwight D. Eisenhower, smashes traditional bottle of champagne. With Mrs. Eisenhower at the launching ceremonies are, left to right: Mrs. Eugene P. Wilkinson, matron of honor; John Jay Hopkins, chairman of the board and president of General Dynamics Corp., builder of the *Nautilus*; Commander Edward L. Beach, Naval aide to the President.

JUST ANOTHER PRESSURE VESSEL

Building of the *Nautilus* was not too radically different from the construction of a large pressure vessel. The welding of her inner hull was done in sections. Each section was composed of three curved plates that were assembled into a full circle. When alignment had been completed on a big jig, the longitudinal seams were welded inside by hand to a depth of about 20% of the total plate thickness. Then—and here is the remarkable part—each section was welded circumferentially by submerged-arc in a downhand position. Only in the downhand position was it possible to use a tractor-type, single electrode submerged-arc welder.

The staff of Electric Boat requested a series of specially built turning rolls to accommodate the giant hull. Altogether, there were 12 sets of idler wheels. These were spotted at inter-



weld the "Nautilus"

vals according to weight distribution. Before the hull was jacked up, the rolls were placed on precompressed pads of rubber (see top left picture) so the rolls would give around the contours when the weight was taken by the turning rolls.

Two pairs of rubber-tired drive wheels were geared in tandem. The rubber tires provided better traction and better following of the hull contour. When the welder was on top for downhand welding, the hull literally "walked around" beneath the welding arc.

As each section was welded to the next, lead ballast was added to counterbalance the uneven distribution of weight caused by the contours of the hull. By the time a 48-ft section had been welded together, the 12 idlers were spaced 6 ft apart and were carrying a combined weight of over 350 tons.

Before welding, the circumferential butt joints were preheated to approximately 150 F by water-cooled, low-frequency, 60-cycle induction coils. The coils were wrapped around the hull and were placed on each side of the butt so that each side had a complete dual wrap. The same equipment was also used to maintain an interpass temperature of 150 F.

The preheat coils were made of extra-heavy copper tubing. Each was connected to the secondary side of the induction transformer. The secondary voltage was about 150 volts. The amperage varied but was close to 1,200 amp on each bank of coils. The coils were insulated with a composition similar to compressed fiberglass and were held in a block framework equipped with small wheels. These allowed the hull to rotate inside the stationary heating coils. To help maintain the heat, a portable house or shelter was placed over the entire butt joint.

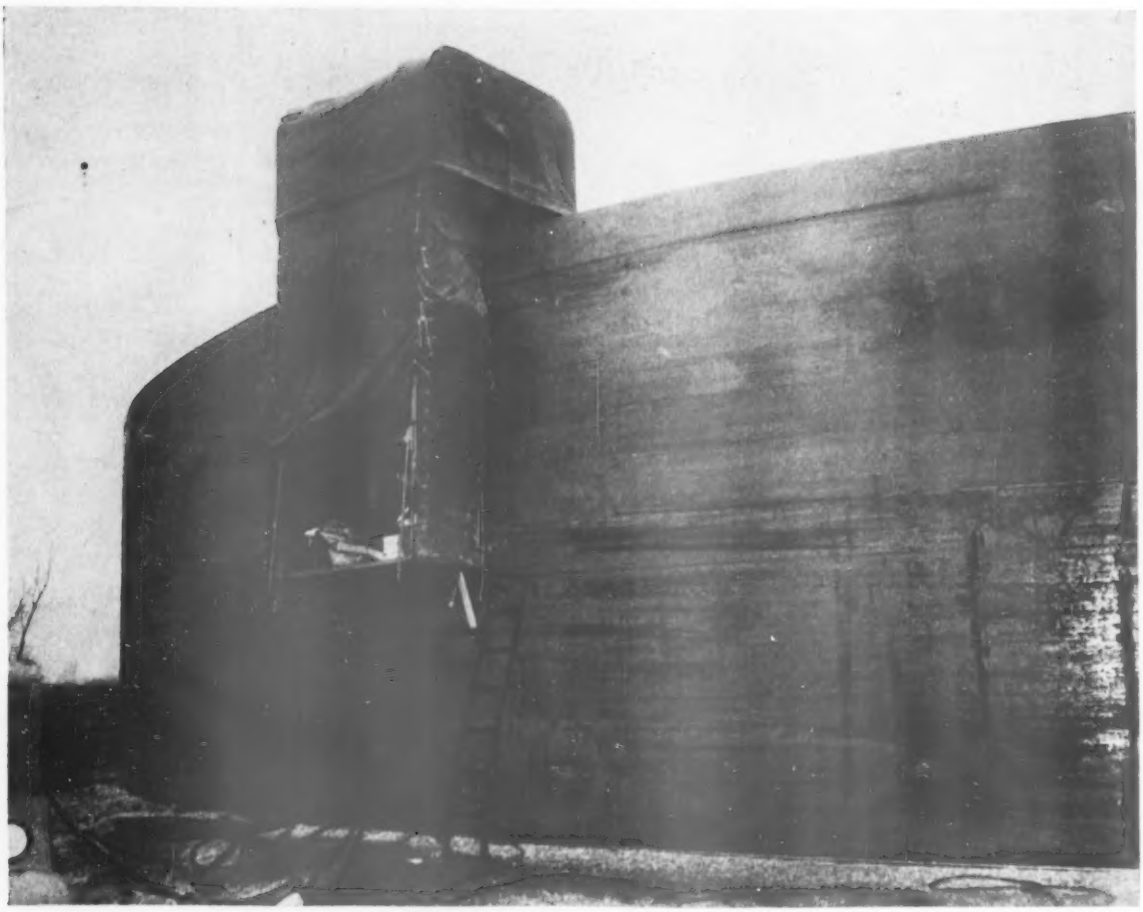
When Nautilus Sees Action

From a hideway in the vast depths of the sea, the *Nautilus* will be able to lauch guided missiles with atomic war heads at supersonic speeds. Her atomic power will enable her to stay beneath the surface for long periods without refueling. For the crew, the *Nautilus* will carry a supply of high-pressure oxygen as well as a snorkel breathing tube. Then, too, the Bureau of Ships is working on a device to take carbon dioxide out of the old air and separate and recirculate the oxygen.

The *Nautilus* has a smooth hull to facilitate her below-the-surface travel and a bulbous bow—blunt rather than knifelike—to lessen friction beneath the surface by permitting a smooth flow of water around the hull.

There have been two other submarines in our Navy named *Nautilus*. The first did not see active duty, but the second was a World War II fleet-type and was active against the Japanese. She sank enemy ships representing more than 89,000 tons—one a carrier. Three of her torpedoes sank the carrier *Soryu* after the enemy ship had been left dead in the water.

A second atomic submarie named the *Sea Wolf* (after a famed submarine of World War II) will be similar to the new *Nautilus* but is not a sister ship. In place of pure water as the coolant, the *Sea Wolf* will use liquid metal as a medium for transferring heat from the reactor to the steam generator. The AEC is building a land-based prototype of this second nuclear power plant at West Milton, New York. (See "Atom Apple," Welding Engineer, July, 1953.)



Vertical welding of field tanks

Submerged-arc welding in the vertical position seemed a natural follow-up to horizontal welding. Graver Tank & Mfg. Co. went ahead with research and came up with the apparatus and procedure described here.

BY FELIX TANCULA

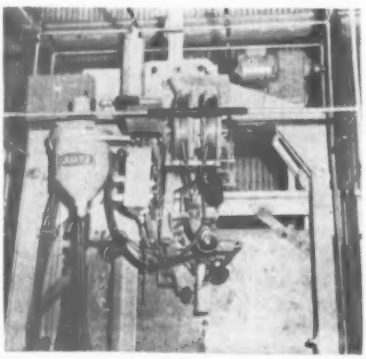
CONVENTIONAL automatic submerged-arc welding applications call for the use of this process in the flat position. Unfortunately, not everything to be welded can be positioned. This is particularly true of ships, oil-storage tanks and similar large objects, so experiments in using submerged arc for out-of-position welding have been undertaken.

The first results led to the development several years ago of horizontal welding. Now comes another milestone in its application—vertical welding.

The advantages of automatic welding are well known. When Graver Tank & Mfg. Co., of East Chicago, Ind., developed its machine and process for submerged-arc welding of horizontal joints in field erected tanks, it was only natural that the firm would search for an automatic means of welding vertical joints.

Presently undergoing tests is such a welder. Developed by Graver's welding research department, the apparatus, for the most part, consists of standard welding components, with the basic pressure head devised by the company.

Identical welding heads are mounted on each side of the machine. A carriage hangs on the free edge of vertical shell plates and is power-driven or manually propelled to other seams. Mounted to the carriage are twin vertical steel columns, which straddle the plate to guide the head assemblies along the vertical joint.

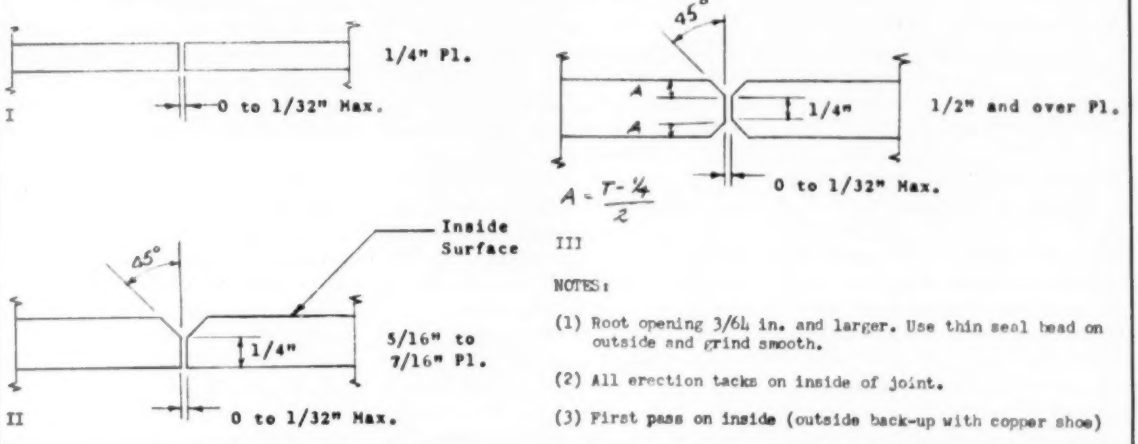


WELDING head at completion of a vertical seam on plate in the lab

Welding procedures and plate preparation

Plate Thickness, Inches	Joint Design		Arc Current, Amperes	Arc Voltage	Arc Travel, ipm.	Roller No.	Electrode Elevation	Oscillation, per min.	Arc Swing, In.
1/4	I	1	340/360	25/27	16	R-6	1-1/8	60	1/8
		2	320/340	25/27	16	R-6	1-1/8	60	1/8
3/8	II	1	440/460	26/28	14	R-5	1-1/4	40	5/32
		2	340/360	25/27	14	R-6	1-1/8	40	1/8
1/2	III	1	440/460	26/28	14	R-5	1-1/4	40	5/32
		2	420/440	26/28	14	R-5	1-1/4	40	5/32
5/8	III	(1	440/460	27/29	12	R-5	1-1/4	35	5/32
		(2	320/340	28/30	12	R-5	1-1/4	35	3/16
		3	460/480	28/30	12	R-5	1-1/4	35	5/32
3/4	III	(1	500/525	27/29	12	R-5	1-1/4	35	5/32
		(2	340/360	28/30	12	R-5	1-1/4	35	3/16
		3	580/600	29/31	12	R-5	1-1/4	35	5/32
1	III	*(1	530/550	32/34	10	R-5	1-1/4	30	5/32
		(2	450/470	29/31	10	R-5	1-1/4	30	3/16
		*(3	560/580	32/34	10	R-5	1-1/4	30	5/32
		*(4	440/460	29/31	10	R-5	1-1/4	30	3/16

* 3/8" Asbestos rope under pressure strip or special shape roller, R-9.



NOTES:

(1) Root opening 3/64 in. and larger. Use thin seal bead on outside and grind smooth.

(2) All erection tacks on inside of joint.

(3) First pass on inside (outside back-up with copper shoe)

Gravity-Adjusted Head

It's gravity that adjusts machine to plate. The heads are linked to the columns so that they follow plate surface regardless of irregularities.

The weld-supporting device has a grooved pressure roller and electrode nozzle that are held in a predetermined space relationship to each other and to the plate surface. A compressible strip of glass fiber is fed under the nozzle over the pressure roller and onto the plate surface. Continuous and uniform flux coverage is provided.

Flux is recovered by means of twin vacuum hoses that bear along the edges of the glass-fiber strip. This pressure strip is the mechanical means that provides the answer to the problems of holding deposited metal in a vertical seam until it solidifies.

The entire apparatus, including the head assemblies and superstructure, weighs 2,600 lb. Company spokesmen said plate as thin as ¼ in. can support the device.

Welding current is provided by four d-c selenium-rectifier machines. Current for light plate is 350 amp, for heavier plate 450 to 475 amp. These settings are not so high as those used in normal flat-position, submerged arc welding.

Wire used by Graver generally has been 3/32-in., low-carbon, rim-steel; the covering flux has a high-silica base. Two wires fed into the nozzle emerge in contact, simulating a ribbon electrode. So far, use of two wires has been mandatory—a single wire electrode doesn't spread the heat enough. Researchers have used wire as thick as ⅛ in., but they found this heavier diameter tends to deposit more metal than the unit was capable of handling efficiently.

One Head Now Trails

The heat problem presented itself in another way: when heads were placed opposite one another, it was found that simultaneous welding generated too much heat. Therefore, one head now trails the other in the welding operation by about 18 in., except during the first pass. In the initial pass, a copper back-up bar is used on

(Continued on page 51)

New flames for torches

THE FOLLOWING article is a survey of a field of research that could possibly produce better welding methods. It should not be interpreted as the presentation of either original thought on the part of the author or the final results of his research written as a technical report. It does attempt to gather together the results of outside research that might some day be of use in the welding industry.

BY JAMES A. BROWNING

Assistant Professor of Mechanical Engineering, Thayer School of Engineering, Dartmouth College

EVER since the metal industries accepted the value of high-temperature flames for use in oxygen cutting and welding operations, the same gaseous fuels have for years dominated the field—acetylene, hydrogen and, more recently, propane and butane for cutting purposes. Recent activity in the rocket propulsion field now makes it evident that special fuels may be formulated to fit particular circumstances and will perform better than the more classical hydrocarbon combinations. Fuels that are today of interest only to the research chemist may perform common welding tasks tomorrow.

The efficiency of a flame for a welding or cutting torch is its ability to heat a unit area of surface in unit time per unit of heat input. It may be expressed as a ratio:

$$\text{Flame efficiency} = \frac{\text{Heat absorbed by metal}}{\text{Heat supplied by fuel}}$$

In practical applications, the flame efficiency must be balanced by the cost of producing the flame and its physical and chemical effects on both the operator and the metal.

WHAT MAKES EFFICIENCY?

Three properties, which differ with fuel composition, govern the efficiency of the heat transfer to the metal surface. These are: (1) the specific heat release (heat release per unit volume of the flame), (2) the flame temperature and (3) the ability of the products of combustion to transfer this heat to the plate surface.

In analyzing the problem, the third factor is the one most often neglected. Experiments performed at the Thayer School with benzene and gasoline flames of nearly equivalent theoretical flame temperature have shown that the higher the carbon-to-hydrogen ratio of fuel, the higher the preheat rate. The reason would appear to be the presence of incandescent carbon particles within the flame of the higher carbon fuel, which particles expedite radiant heat transfer.

In a comprehensive study of the various possible fuels, the first question to be asked is: What use of the fuel is to be made?

In oxygen cutting, for instance, any substitute fuel must produce cuts of equal, or higher, quality at less total operating costs than present fuels. A new fuel might be able to produce faster preheating than acetylene, yet it would be of no commercial value if the total cost of cutting were not reduced. Such fuels as cyanogen fall in this classification.

The introduction of a new fuel that lowers total costs must be seriously considered, even though it requires longer preheating times than acetylene. An example is propane, now growing in importance as a cutting gas.

Many single-purpose fuels are possible. For brazing purposes, a flame providing fluxing action has taken its place in industry. The use of liquid fuels with the fluxes dissolved in them might simplify the required apparatus. Various additives might be used to increase the heat transfer rates discussed above. The possibility of adding a fine carbon or a metallic suspension to a liquid fuel has evoked interest in the gas-turbine field.

HYDROGEN-FLUORINE FLAME

The use of hydrogen-fluorine and cyanogen-oxygen flames in welding are remote as they both have features that cannot be tolerated in industry. However, the work being carried on in the investigation of these flames is of primary importance because it sheds new light on the combustion process. Research into the flame properties of these, at present unusable, fuel gases may well lead to the discovery of more practical fuel, giving high flame temperatures.

The hydrogen-fluorine reaction is simplified by the following equations:

$$H_2 + F_2 \rightarrow 2HF$$

The flame produced has a temperature of 4,300 ± 150 K.* When compared with the 3,700 K flame temperature of acetylene, this figure is quite imposing.

During a phase of their work, Priest and Grosse discovered that the hydrogen-fluorine flame would not only weld all the common metals other than alumium, but that it would cut copper in much the same fashion as oxygen cuts steel (1). The copper

*Kelvin or absolute temperature is degrees Centigrade plus 273. 4,300 K = 4,027 C = 7,280.6 F. 3,700 K = 3,427 C = 6,200.6F.

fluoride formed in the reaction between copper and an excess of fluorine injected through the flame has a melting point lower than the copper metal. Thus, it is a self-fluxing action, and a clean cut is produced.

The catch is that the two elements are so reactive that they cannot be premixed prior to combustion. Therefore, postmixing, with its inherent difficulties, must be resorted to produce a diffusion flame.

The reaction between poisonous cyanogen gas (N:CC:N) and oxygen produces an even higher flame temperature. Using the Sun as a standard, this temperature has been determined to be 4,650 ± 150 K (1). With careful handling, it is possible that cyanogen could find useful applications.

The development of a liquid fuel torch has provided a convenient and practical tool for the testing of a great number of liquid fuels under actual cutting conditions (2). The torch has been designed primarily for the use of gasoline and benzene. However, with a slight change in tip structure, fuels with vapor pressures as low as kerosene may be burned. Gaseous fuels may also be used in the same unit.

In testing the effect of increasing length of the paraffin chain on the quality of oxygen cuts, the following fuels have been used; propane, pentane, heptane, n-octane, iso-octane, gasoline and kerosene. The flame produced in each case appears visually the same. However, the longer the molecular chain the cleaner the cut! Gasoline produces cleaner cuts than propane, and kerosene the cleanest of all for those fuels tested. It has been hard to account for this.

Atmospheric nitrogen diffusing from the air into the oxygen-metal reaction may produce a quenching effect. The temperature towards the bottom of the kerf would be lowered, and the result would be a greater tendency for slag adherence. The effect of the heavier fuels may be the production of a more efficient blanketing envelope composed of the products of combustion. This blanket would isolate the cutting zone from the atmosphere. The extent of this envelope is roughly that of the visible secondary combustion cone.

Paraffin fuel flames are oxidizing and are thus unsuited for fusion welding processes. The aromatics on the other hand show promise as possible welding fuels. However, due to their lower flame temperature, it is doubtful that they will ever compete with acetylene in this field.

A great deal of research is presently being conducted on the use of such liquid fuels as the butynes, pentynes and the higher-boiling-point acetylenic compounds. They are in general not so unstable as acetylene, and shipping and storage problems would be reduced. They could be used under high positive pressure to produce the high heat release of flames stabilized in supersonic streams.

The use of small-scale rocket devices in such fields as metal cleaning is intriguing. The high-velocity (5,000 feet per second), high temperature (4,500 F) jet produces much higher heat-transfer rates than the open flames used for metal cleaning and also gives a violent scouring action.

High Temperature Expensive

The long-range objective of this research is to discover fuels which will give higher flame temperatures. Unfortunately, known compounds of this type are rather expensive. An encouraging example, however, of the reduction in cost of what was once a rare fuel is hydrazine. This fuel is in high demand by rocket engineers, and the demand has created new facilities for its manufacture, which have lowered its cost. Hydrazine has become so plentiful that it is now being used to control the growth of grass along highways. It could prove to be a useful fuel in the welding field. Although research of a nature that would be of interest to the welding engineer is being carried on, little practical information has been released to date on this fuel.

The panacea to the fuel problem would be to increase the combustion reaction rate by the addition of a small amount of additives. It is known that the combustion process goes through a series of definite steps before completion. The formation and brief presence of such chain carriers as aldehydes and peroxides have been detected. These compounds are quite unstable, and their concentration might well determine the reaction rate. Compounds containing these active radicals could be added to the fuel to step up the flame velocity. However, results compiled to date by many independent investigators, covering hundreds of additives, show nothing but a negative answer to this "radical enrichment".

The scope of research on the improvement of welding fuels is still wide open, and it is almost certain that the welding field will benefit from new discoveries.

References

(1) Priest, H. F., and Grosse, A. V., "Hydrogen-Fluorine Torch", *Ind. & Eng. Chem.*, v. 39, 431 (1947)

(2) Licensed for manufacture and sale to the Worcester Taper Pin Co., Worcester, Mass.

VERTICAL SUBMERGED-ARC

(Continued from page 49)

one of the heads. In ¼-in. plate, a single pass on each side does the job at a welding speed of 16 ipm per pass. (See table). On 1-in. plate, multiple passes are made on each side, with the 18-in. spacing being maintained. (In horizontal welding, Graver has achieved welding speeds of from 26 to 50 ipm.)

Mechanical properties of welds laid by the vertical machine are said to compare with those of parent metal used in tanks (ASTM structural steel A283-53T, Grade C); that is, tensile strength between 55,000 to 65,000 psi, elongation 24% in 2 in. Weld surfaces have so far tended to be relatively non-uniform, with non-uniformity increasing with increasing plate thickness.

Preparation in plate ½-in. thick and more is a 45-deg (90-deg included) angle on each side; in plate 5/16 to 7/16 in. thick, 45 deg on one side. Plate ¼ in. thick is butt welded, with no beveling.

Since the courses (or rings) for tanks are generally plate 28 ft long and 8 ft wide, the vertical welder is not called upon to weld more than 8 ft in a single pass. (In contrast, the firm's horizontal welder has been used continuously for 315 ft on a 100-ft-diameter tank. On the horizontal machine, a flux-recirculating device makes this possible.)

First use of the vertical welder in the field was in the fabrication of a tank 40 ft high by 100 ft in diameter at Blue Island, Ill.

On field tanks, vertical automatic welding is now estimated to be twice as fast as manual welding including set-up and handling time. Excluding set-up time, it is roughly three times as fast.

Welding mild steel with magnetic flux

Automatic welding of mild steel with magnetic flux has been done in Europe for some time. But it's the semiautomatic application of the process that is likely to find the most widespread use in the United States.

BY FELIX TANCULA

ONE of the more recent contributions to the technology of welding is the semiautomatic welding of mild steel through the use of magnetic flux. A granular flux of a magnetic metal is used, in addition to a bare electrode wire, to produce the alloying elements of the weld metal as well as the fluxing agent for slag, arc shielding, etc.

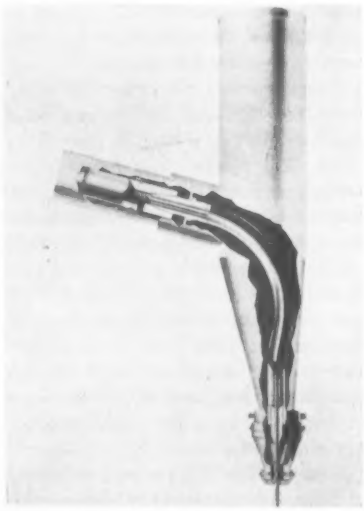
In Europe this method has been used for automatic welding of mild steel for some time. Greatest interest shown in the United States, however, is in the manually applied, semiautomatic application. American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill., claims the new process combines the advantages of hand welding and automatic welding, while eliminating most disadvantages.

A bare wire is fed through a hand-held hopper containing magnetic flux. The flux clings to the wire as it leaves the hopper because a magnetic field has been established by the welding current flowing through the wire. Thus the electrode wire (Amsco uses a 5/64-in. copper-clad steel wire fed from a continuous 30-lb. coil) reaches the arc with a flux covering that contributes the advantages of the coating on a manual electrode.

EITHER A-C OR D-C

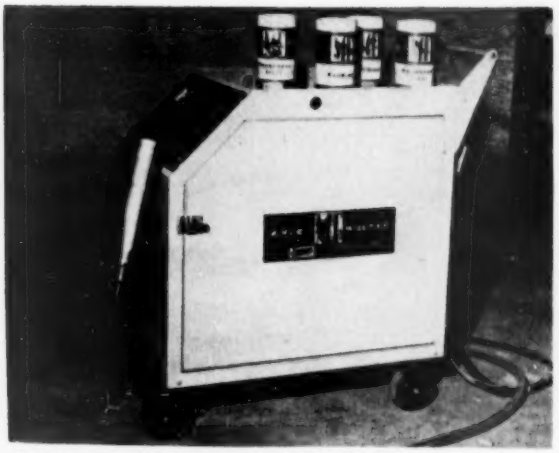
American Magnese has a machine that can be connected to any a-c or d-c welding source. It operates over a current range of 150 to 500 amp. The new equipment is essentially a wire-feed and arc-control device that will not make basic welding equipment obsolete. The welder consists of a hook-up cable, a small chassis mounting an electrode-wire reel, motor-driven feed rolls and a flexible 14-ft tube through which electrode wire is fed to the hopper.

When an arc is struck, the welding current closes a relay that connects a 32-volt drive motor to the current source, and the motor feeds wire to the arc. Motor voltage and speed depend on voltage across the arc. Should the operator pull away from his work, increased arc voltage speeds up the motor, which feeds the wire faster. Should he lean toward his work, decreased arc voltage slows the motor, and wire-feed speed is reduced temporarily to maintain constant arc length.



MAGNETIC gate stops the flow of flux when no welding is being done

WEIGHT of hopper head on magnetic flux welder compares to weight of a standard manual electrode holder



MODEL on casters has same equipment (except for the cabinet) as smaller pear-shaped one

. This self-compensating feature holds the arc gap steady at any length preset by the operator on the machine's control rheostat. Even a novice can thus maintain an arc, and beginner weldors quickly learn to operate the apparatus. (The writer, no weldor, he, was welding after a few minutes' instruction.)

Wire Becomes Coated

A pushbutton permits feeding of the wire without striking an arc. Thus several inches of bare wire may project from the hopper nozzle before welding. A pinch of flux can be placed where the weld will begin, to make starting easier when welding with low a-c current settings, and to shield the arc produced by the small length of bare wire.

Once the arc has been struck (by simply bringing the hopper head down close to the work), the automatically fed wire comes out of the hopper coated with the magnetic flux. In effect, the weldor is using a flux-coated electrode, but he has these advantages over manual welding: faster speeds, more convenient operation, elimination of electrode stub ends, longer welding time (the operator can weld steadily for about 15 or 20 minutes, if desired). He also has certain advantages over submerged-arc welding such as readily portable equipment and adaptability to a variety of weld metals. By simply changing the flux nozzle, however, he can weld by the submerged-arc method.

A further great advantage is that the magnetic-flux method retains the visibility and flexibility of manual welding. The arc is open; the work can be observed during operation. A disadvantage: the gravity hopper restricts the method to downhand welding.

Probably the most interesting features of the equipment are: (1) the hopper and (2) the flux. These are the keys to the claims for more efficient welding.

Magnetic Gate in Hopper

The hopper has a magnetic gate. This consists of several tiny permanent magnets in the walls of the nozzle orifice (see photo). When welding current is shut off, the flux clings to these magnets in tufts and thereby blocks the ring-shaped opening around the electrode wire. However, when the arc is struck, the magnetic field around the electrode wire is stronger than that set up by the permanent magnets. Thus the flux is drawn down through the opening with the wire.

The major ingredient of the flux is iron. The amount of flux (by weight) is influenced by density and granule size (both of which can be controlled) and by the outside diameter of the magnetized flux coating. This diameter is determined by the size of the orifice and can be easily varied. The bayonet fastening of the control-orifice cap permits quick changes. These caps are light and so inexpensive as to be almost expendable, according to American Manganese.

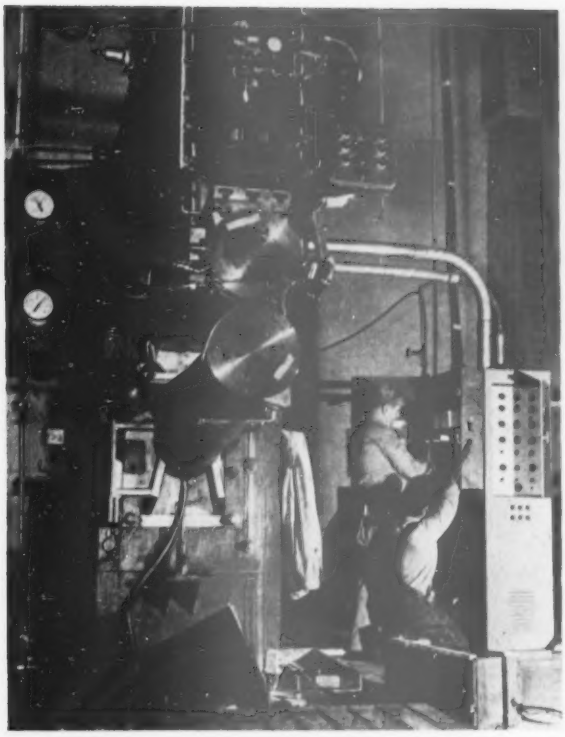
In addition to the flux for use in welding mild steel, the firm at this writing has a flux for welding manganese steel and another for build-up or hardfacing. Company spokesmen said recommended amperage settings for mild steel, manganese steel and build-up were, respectively, 250, 200 to 250, and 275 to 300.

Whether welding or building up, the same mild-steel wire is used; it is the flux that is changed. This speeds up change-over time. Amsco claims the manganese-steel flux puts down a weld with better physical properties than can be accomplished with any manual manganese electrode.

The firm states that the mild-steel flux does not meet American Welding Society specifications for elongation for code work. Elongation properties should be higher. Company spokesmen, however, stressed the point that physical properties of mild-steel deposits are comparable to those laid down by the new manual electrodes with iron powder in their coatings.

Deposition rate is 3 to 26 lb of weld metal per hour, depending upon current limitations and type of flux used. In mild-steel welding, the amount of flux deposited in ratio to the wire is 1 lb to 2 lb. The magnetic flux is 65% efficient; *i.e.*, that percentage of it becomes alloying elements of the weld metal. The remaining 35% provides arc shielding, deoxidation, slag coverage and arc stabilization.

The firm presently has two models of the magnetic flux welder, both of which come without the power source. A pear-shaped portable model weighs only 34 lb and can be hung on the wall. A larger cabinet model mounted on casters provides storage space for fluxes.



EMPLOYEES ready one of Ryan's largest seam welders

WELDING parts of a cobalt-chromium-tungsten alloy

New methods of resistance

Slope control, preheat and postheat, deflection firing, fixed-increment adjustment for heat and timing, compensation for shunt effect, series-parallel tap switches, utilization of the drift due to direction of welding current . . . these are some of the gimmicks which enable Ryan Aeronautical Co. to get the most out of resistance welding.

BY J. R. FULLERTON

Development Laboratories, Ryan Aeronautical Co., San Diego, Calif.

As told to Thomas A. Dickinson

THOSE of us who are concerned with resistance welding at Ryan Aeronautical Co. have good reasons for believing we have a better-than-average opportunity to become familiar with all the newest methods of resistance welding.

First of all, we now have 95 resistance-welding machines, types of which include: (1) three-phase, frequency-converter spot, roll-spot, and seam welders; (2) three-phase electrostatic, stored-energy spot and roll-spot welders; (3) three-phase, dry-disc rectifier spot and seam welders; and (4) single-phase a-c spot, seam and spot-tack welders.

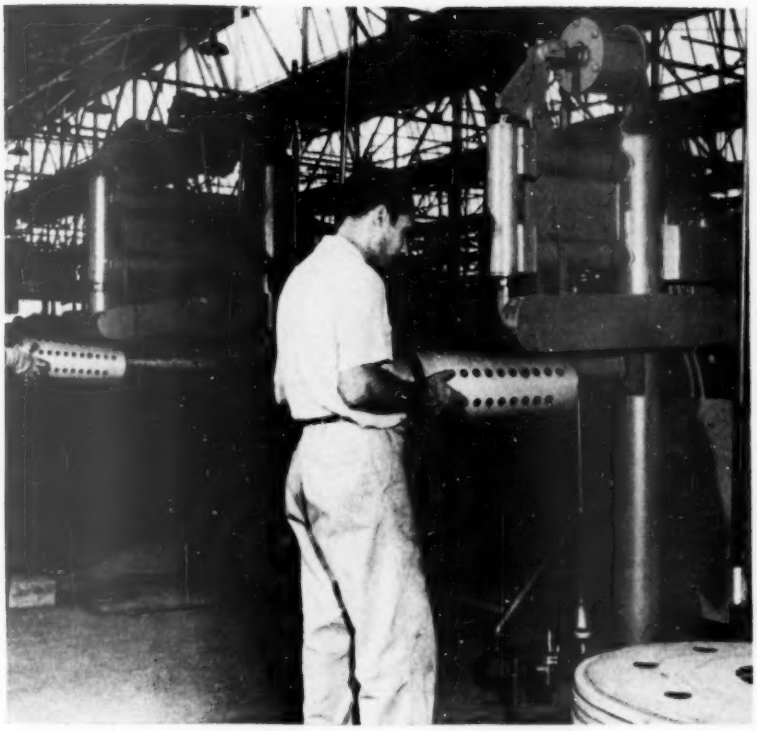
Secondly, unlike many manufacturers, we work with a large and varied number of metals and designs. In addition to the aluminum and magnesium alloy commonly used in aircraft work, we weld most of the stainless steels, mild steel, titanium, Inconel, Rosslyn metal, Haynes-Stellite N-155 and Armco 1714 CuMo.

It is also worth noting that most of our applications for resistance welding involve serious responsibilities since the structural failure of one of our assemblies could result in a loss of life.

Because every machine has limitations as to capacity and flexibility, we have found that the success of a resistance-welding program is primarily dependent on the selection and use of proper equipment. While versatility is a desirable characteristic, each machine must be purchased with specific types of materials, gages, designs and production operations in mind.

THREE-PHASE MACHINES

In this connection, we have selected three-phase, direct-demand machines for both production and experimental work with aluminum alloys, stainless steels, Inconel, titanium and mild steels. Ratings of these machines range to 120,000 amp of short-circuit current and 11,000 lb of electrode force, and they are capable of continuously producing crack-free structural welds in two sheets of 0.187-in. steel or 0.125-in. aluminum to military specifications.



JOINTS are flattened where perfectly smooth welded surfaces are required

welding at Ryan

We still make extensive use of electrostatic spot, seam, and roll-spot welding for the production of aluminum and magnesium structural assemblies (as well as non-structural assemblies comprising other materials) because they are relatively insensitive to power variations, have a long tip life, can perform with minimum distortion and will consistently produce crack-free structural welds in some materials—for instance, in 24ST Alclad sheets with thicknesses up to 0.081 in.

Our dry-disc rectifier machines were purchased to supplement our single-phase equipment in welding stainless steels, nickel alloys and related metals. They are not used in connection with aluminum alloys. Our selection of dry-disc equipment was primarily attributable to simplicity of control.

Single-Phase Machines

Despite their disadvantages (as compared with newer types of equipment), we still make extensive use of single-phase machines in work with stainless steels, nickel alloys, low-carbon steels and titanium—including some of the heavier gages of these materials—because of their reliability, simplicity and low cost.

Among "difficult" welding jobs, we classify the assembly of materials with extreme thick-thin ratios where minimum edge distances and reduced electrode pressures are necessary . . . likewise materials that have a tendency to "spit" excessively. We have found that both of these problems can be satisfactorily solved by making effective use of a slope control.

In work with heat-treatable steels, it is virtually impossible to produce top-quality welds without preheat and postheat controls. The addition of such controls to one of our smaller machines enables us to accomplish welding that formerly had to be done on one of our larger welders. These controls are used in the same manner as slope controls and can be used for many different pulsation welding effects with reasonable success.

In welding aluminum alloys, we feel that deflection firing is a necessity. This is accomplished with a resilient member incorporating a dial indicator, microswitch and mircometer adjustment; it is situated between the electrode and pressure members of the machine and is calibrated in pounds of electrode force. When properly set, it permits the current to flow only at the exact pressure desired. In this function, it is much more accurate than gages that indicate air pressure at a point distant from the actual work.

A good deflection firing system will cut welding current when pressure drops, prevent firing under light pressure, provide increased control with less maintenance of the pressure system and monitor electrode pressure throughout the welding cycle.

Where welds must be duplicated with exacting precision, we favor the use of small fixed-increment adjustments for heat and timing control. However, this may well be nothing more than a matter of personal preference.

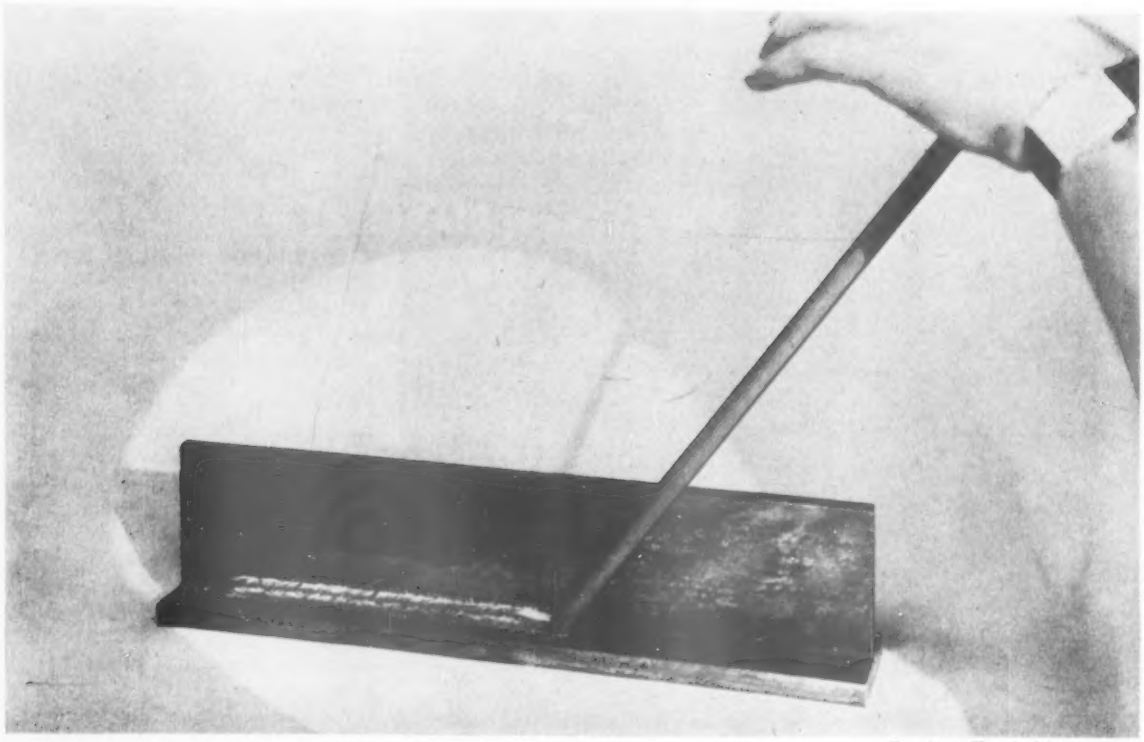
To accelerate production and obtain accurate spacings in the production of seam welds and spaced spot welds, we have found roll-spot accessories to be extremely useful. Care must be taken, though, that reduced accessibility does not make their installation impractical.

In welding critical assemblies showing a tendency to splash and crack, rejections and rework have been minimized. We use a device that automatically reduces the heat of a first spot weld in a set-up and thus compensates for the "shunt effect."

Series-parallel tap switches have saved us much valuable time in setting up major change-over jobs in large machines. We feel that a series-parallel transformer tap system is an absolute necessity where fine heat control is desired and a wide range of work must be accomplished.

Analysis indicates that uniform penetrations in sheets of different thicknesses can be obtained by utilizing the "drift" due to direction of welding current. Such drift has often been an important factor in obtaining proper heat balance. This is among the newer refinements to be worked out in detail.

Relatively few of the possibilities of modern resistance welding have been realized in any factory at present. But if recent years are a guide, we can certainly be optimistic about the future.



Courtesy Harnischfeger Corp.

New iron-powder electrodes

A round-up of information and opinion on this useful tool for arc welding

BY CLYDE B. CLASON

ONE of the most talked about exhibits at Cleveland's 1953 Metal Show was a booth where demonstrations were conducted of a type of electrode hitherto little known. The weldor was required to strike an arc, but he did not have to maintain it since welding could be done while the electrode coating was touching the base metal. Once the arc had been started, all that the weldor had to do was drag the electrode along the seam.

Because of the presence of comparatively large quantities of powdered iron in its heavy coating, this new electrode is called a "powdered-metal" or "iron-powder" or "powder-coated" electrode.

No AWS Number—Yet.

There has been much talk of an AWS-ASTM specification or specifications for the powder-coated electrode, but as yet this is all smoke and no fire. A telephone call to American Welding Society headquarters elicited the information that no AWS classification number has as yet been definitely assigned to any electrode of the iron-powder class. All our informant would say is that the AWS-ASTM Committee on Filler Metal is working on such a specification (or perhaps several specifications) but that properties have not yet been defined and further testing is necessary.

Even without an AWS number, however, the number of manufacturers who have announced electrodes of the iron-powder class has grown in a year from one to seven. And some of the claims that have been made for the powdered-coated rods have been remarkable for their all-embraciveness, if such a term may be coined.

Declared one enthusiast: "Powdered-iron electrodes will obsolete existing electrodes like the jet plane has obsoleted propeller-driven fighter planes."

Without any question the jet plane is a useful fighting tool, but as yet it has not driven all propeller-type planes from the Air Force. Neither has the iron-powder electrode yet run all earlier coated types out of business. The enthusiast responsible for the jet plane simile wrote an article which we ran in the May, 1954, issue of WELDING ENGINEER. Wishing to be wholly fair on this controversial question, we titled the piece, "The case for. . ." and invited readers to submit arguments on the "con" side.

One of our readers, an actual user, heeded the request and came forward with a second article, which ran in August, 1954, under the title, "The case against. . . ." The facts and figures cited were around 180° from the conclusions reached by the author of the initial article.

Well, "so many men, so many opinions," as the Latin phrase pungently expresses it. And the number of opinions has grown prodigiously along with the number of men who are interested in making, selling and using the iron-powder electrode.

To us, it seemed that these opinions were running wild along the range like calves untouched by the branding iron. We felt that it was high time for a round-up.

We sat on the seat of our editorial pants and composed a letter addressed to the seven leading manufacturers of iron-powder electrodes. Each manufacturer was asked to answer six questions. As follows:

1. What iron-powder-coated electrodes do you manufacture?
2. What have been your customers' experience with them?
3. Where do you think the best fields of application are?
4. Are they going to be an aid in the training of weldors?
5. Where should they not be used? For what reasons?
6. What else do you think we should say about powder-coated electrodes?

As one might expect, the unanimity in answers to the above questions was not startling. Unanimity was remarkable, in fact, only by its almost complete absence in some cases. To summarize briefly:

The number of electrode types manufactured ranges from one to four. However, the four types mentioned by one manufacturer include two he has not yet announced. Several manufacturers make two types, corresponding to the E-6012 and E-6020 mild-steel electrodes. The E-6012 type has a rutile (titanium dioxide) coating, and the E-6020 type a coating described as "mineral." (The AWS-ASTM specification for E-6020 electrodes gives the main ingredients of the coating as silica and iron oxide.) It must not be supposed, however, that the powdered-iron electrodes will necessarily produce the same results or operate under the same conditions as their opposite numbers among the conventional mild-steel electrodes.

Customers' experiences seem to have been satisfactory in the main. However, in the answers to this question, it was not always possible to disentangle actual customers' experiences from manufacturers' performance claims.

Opinions were widely divided on where you will find the best fields of application. One manufacturer said in tank fabrication. Two said production welding. A fourth maker thought they would be used chiefly in high-speed welding of horizontal and downhand fillets, a fifth in the fabrication of mild steel involving plate and rolled sections. Two manufacturers were less optimistic and would reserve use "for static-loaded welds where low quality weld material would prove satisfactory" and "where bead appearance is more important than mechanical properties."

Further division of opinion was found in the question pertaining to weldor training. Some manufacturers said, "Yes," because these electrodes are so much easier for the beginner to use. Others said, "No" on the ground that the ability to use an iron-powder electrode would teach the beginner nothing at all about conventional arc welding. Let him learn the hard way first, they said.

No uniformity at all was found in the answers to the question of restrictions on the use of the new electrodes. Here are four opinions on where these electrodes should *not* be used:

On high-alloy, galvanized and corroded steels.

For position welding.

Where locked-up stresses are likely to be encountered.

Where X-ray inspection is required.

The "what else" question was, of course, a catch-all, so it is little wonder that no two answers were alike in any respect. Some interesting points were brought out, however.

To satisfy the curiosity of our readers, here are manufacturers' detailed answers. (We have omitted the names of the manufacturers and the brand names of their electrodes to avoid any chance that statements made for this round-up might be used competitively. For this reason, the seven manufacturers are referred to as A, B, C, D, E, F and G.)

Question 1: What iron-powder-coated electrodes do you manufacture?

Manufacturer A: "We manufacture and sell two types of iron-powder-coated electrodes: one type for downhand operation and the other for out-of-position welding. The latter are suitable for vertical-up, vertical-down and overhead welding."

Manufacturer B: "We are manufacturing at the present time two types of iron-powder electrodes. Since these do not have AWS classifications as yet, we can perhaps refer to them as the rutile type and the mineral type, or the E-6012 and the E-6020 type. The rutile type was designed for fillet welding, while the mineral type was designed for deep-groove butt welding.

"Eventually, we will be manufacturing four different iron-powder electrodes, each designed for a specific application. Two of these have not yet been announced but will be shortly. One of them will be for high-tensile applications."

Manufacturer C: "We manufacture two iron-powder electrodes, known currently as the E-6012 and E-6020 iron-powder types.

Our E-6012 has been developed to give exceptional operating characteristics that appeal to a weldor. The E-6020 was developed to deposit a high-quality weld metal. The coating composition is of the 'hot rod' type, which is generally not as acceptable to the operator as the rutile-base electrode."

Manufacturer D: "We manufacture a heavily coated, shielded-arc mild-steel electrode that employs a high percentage of powdered metal in the coating. It is designed for operation on a-c or d-c (either polarity) and has been approved by the American Bureau of Shipping as an E-6012 electrode limited to horizontal fillets and downhand welding."

Manufacturer E: "At the present time we are manufacturing only the rutile type. We expect to have additional types at a later date."

Manufacturer F: "At present we are manufacturing only a rutile-type modified Class E-6012 electrode for the market. Undoubtedly additional classes of electrodes will be produced in the future."

Manufacturer G: "We make only one: an E-6012 type of electrode with a rutile coating."

Question 2: What have been your customers' experiences with them?

Manufacturer A: "Our customers' experience with these electrodes has been exceptionally good, and our sales of these items are excellent. We have been able to acquire many new customers, who have converted from standard mild-steel electrodes to the use of powder-coated electrodes. There are labor savings in them for welding, also in chipping and cleaning time, which more than offset the higher price of the electrodes. The fact that the welding operators need not be as highly skilled when using these contact electrodes also helps to reduce their welding costs."

Manufacturer B: "Our customers have had uniformly excellent experience with these electrodes. It appears

that an increased rate of deposition on the order of 50% is normal. In addition to the increase in welding speeds, many customers have had excellent cost-reduction results through the elimination of spatter and weld cleaning. The amount of iron-powder electrode produced each month is increasing steadily as they take over more and more of the market now being supplied with the conventional E-6012 and E-6020 electrodes."

Manufacturer C: "Our E-6012 type has been developed to give exceptional operating characteristics. Arc action, bead contour and slag cleaning are all very good, and this has been substantiated in test runs in the shops of selected customers.

"The E-6020 type was developed to deposit a high-quality weld metal. We have obtained exceptionally high ductilities, mild-steel tensile strengths and excellent radiographs in deep-groove welds. The coating composition is generally not as acceptable to the operator as the rutile electrode."

Manufacturer D: "The weld beads are exceptionally smooth, and the weld metal is of high strength, good ductility and sound X-ray quality. High travel speed reduces distortion when welding sheet metal. Under certain conditions, the slag will lift off the deposit by itself. Even where the slag is not self-removing, only a light tap is necessary to make it pop off."

Manufacturer E: "We have been manufacturing this type only a few months, but to date there have been no complaints in regard to weld failures and so forth."

Manufacturer F: "Generally speaking, we feel sure that all of our customers are extremely well satisfied since several million pounds of these electrodes have been sold. Specifically, we have had excellent reports from Tractomotive Corp., Deerfield, Ill., and also from the Dart Truck Co., Kansas City, Mo. We were very pleased with these two applications since we felt that the electrodes could only be applied in static loading conditions. However, both of these weldments involved structures that are subject to extreme shock loads under varying temperatures and appear to be quite satisfactory for field use."

Manufacturer G: "All we can say on this question is that sales skyrocketed as soon as we announced a powder-coated electrode. Sales have held up ever since, so our customers must like them."

Question 3: Where do you think the best fields of application are?

Manufacturer A: "The best fields of application are naturally on mild steel in tank fabrication. Also on everyday welding fabrication of industrial and commercial products."

Manufacturer B: "The best field of application for these electrodes is in production welding. At the present time the application is limited to downhand welding, but with the advanced state of positioning equipment, most production welding is downhand. Machinery parts of all types are being welded with these electrodes."

Manufacturer C: "We believe that the iron-powder types of electrodes will be used chiefly in applications calling for the high-speed welding of horizontal and downhand fillets. This means that iron-powder types could probably supplant a good share of the E-6012 and E-6013 electrodes. It is also probably true that the iron-powder types will find much application in the E-6020 field.

"The E-6020 iron-powder electrode should be used in the same applications that currently require the E-6020 type. The same restrictions now applied to the use of the E-6020 will apply to the iron-powder rod."

Manufacturer D: "Our electrode is recommended for the fabrication of mild steel involving plate and rolled sections. It will provide exceptional economy for single- or multiple-pass welds. The 7/32-in. diameter is an excellent choice. . . in welding horizontal fillets. This type of electrode is excellent on build-up applications because of the high deposition rate and easy slag removal. On such applications, weaving of the arc permits coverage of a large area."

Manufacturer E: "We feel that the electrode can be safely substituted for most E-6012 applications and for some E-6020 and E-6030 applications where weld bead appearance is more important than mechanical properties."

Manufacturer F: "As mentioned previously, we thought that these electrodes would be restricted pretty much to static-loaded welds where low-quality weld material would be satisfactory. There is some indication, however, that the best fields of application are not as limited as we might first expect and that many high-grade weldments have been produced under varying shop conditions.

"The best potential market, of course, is in the field of E-6012 electrodes since they cover the bulk of welding applications. As you know, the AWS specifications covering the E-6012 electrodes do not call for excessively high elongation values, and most powdered-metal electrodes are able to meet these requirements quite sufficiently for the physical properties that the AWS specifications call for."

Manufacturer G: "Production welding at high speeds—tanks, heavy machine bases, road machinery and farm equipment."

Question 4: Are they going to be an aid in the training of weldors?

Manufacturer A: "These electrodes naturally aid the training of welding operators inasmuch as it is not necessary for them to maintain an arc. It is very simple to teach welding operators. All they have to do is to strike the arc for starting and then drag the electrode, and they will produce an excellent physical and good-appearing weld."

Manufacturer B: "I don't think they will be widely used in the training of weldors. It takes some skill to handle the large amount of slag produced by the electrode as well as some skill to handle the higher welding speeds. The electrodes are easier to operate than conventional electrodes, but it is not normally good teaching technique to start with the easiest electrode. Our welding school for many years has been starting operators with bare electrodes. If they can strike and hold an arc with bare electrodes, they will have no difficulty with conventional electrodes.

"One of their big appeals (powdered-metal electrodes) is ease of operation, and welding operators have been universal in their acclaim. In spite of this, I do not think they will be widely used as an aid in training."

Manufacturer C: "The E-6012 iron-powder electrode is probably the easiest to use of all the available electrode types. Less training time is required to teach an operator to use this electrode, but learning its use doesn't aid particularly in the training for use of the mild-steel types."

Manufacturer D: No comment.

Manufacturer E: "We have found it much easier to train a comparatively inexperienced operator to make

good-appearing welds with this type than it is to teach him to use a type with which an open arc is maintained."

Manufacturer F: "There is a very strong possibility that the powdered-metal electrodes will aid in the training of weldors. Most people are able to produce satisfactory-appearing welds after a very short period of training with these electrodes. I believe that the satisfaction of producing a good-looking weld early in a welding training program serves as a good stimulus to the trainee to do better work in subsequent lessons.

"The operator training time on these electrodes has been considerably reduced by most manufacturers. I do not believe, however, that such training will aid a poor weldor in the use of conventional electrodes . . . the real art of welding."

Manufacturer G: "Yes, because they are easier to use."

Question 5: Where should they not be used? For what reasons?

Manufacturer A: "So far as we know now, these electrodes are not applicable on high-alloy steels, galvanized steels and corroded steels. Reason: the penetration achieved is not deep enough to do a good job. We feel quite sure that in the near future the penetration problem will be overcome, and these types of electrodes will also be usable on the above-mentioned problem steels."

Manufacturer B: "They are not being used for position welding. The large amount of slag resulting from the heavy coating interferes with vertical and overhead operation. A great deal of the advantage of these electrodes in higher deposition rates is lost when they are applied in out-of-position joints."

Manufacturer C: "The weld metal deposited by the E-6012 iron-powder rod is of a somewhat lower ductility and considerably higher tensile strength than the standard E-6012 types, but many welding engineers feel that these properties are adequate for many applications. This type (iron powder) should not be used, however, where the design is critical and locked-up stresses are likely to be encountered in a weldment. We have seen applications where failure resulted because of weld metal cracking. If high ductility is required in a weld deposit to offset the residual stresses, it is reasonable to assume that this type of electrode should not be used.

"No doubt the best method of evaluation of this relatively new weld metal is the complete service testing of full-size pieces in all conditions that can be encountered."

Manufacturer D: No comment.

Manufacturer E: "We would prefer not to comment on restrictions in its use until more field data have been obtained."

Manufacturer F: "Our work to date indicates that most powdered-metal electrodes on the market are not capable of meeting normal X-ray requirements associated with class E-6020 electrodes. We believe that in straight weldments such as we have evaluated to date that the speed attainable with these electrodes call for some sacrifice in welding quality when compared with classes E-6010, E-6011 and E-6020. When results are compared with a class E-6012 electrode, however, no apparent reduction in quality is experienced."

Manufacturer G: "Would prefer to reserve comment on this question."

Question 6: What else do you think we should say about powder-coated electrodes?

Manufacturer A: "According to all of our tests—and tests run by many of our better customers—the speed of deposit, the efficiency of deposit and the savings involved in chipping and cleaning time have greatly enhanced the sale and use of these electrodes. Another thing must be remembered: the savings in stub loss due to the increased length of weld produced by each single electrode. As compared to an electrode of a standard mild-steel type, there are less stubs per 100 feet of weld, and this alone is a great savings feature."

Manufacturer B: "Electrodes with powdered-metal coatings use the excess heat available in the arc to increase welding speed. The powdered metal in the coating is melted by this heat and becomes an additional source of metal for the weld, thus permitting an increase in welding speeds. The difficulties of excess current, spatter, gouging, undercutting are minimized, and additional metal is available to make full welds at the higher speeds."

Manufacturer C: "We do not believe that the iron-powder electrode will be the answer to all welding problems or that they will supplant all of the present horizontal fillet and downhand types. We do feel that they have a definite application in certain types of welding where economy is a factor and where the design will permit their use."

Manufacturer D: "A-c or-d-c, either polarity, is recommended for all sizes. The electrode may be held to touch both legs of the fillet, but most experienced operators prefer using a free, short arc. A free arc permits weaving to produce a wide, flat bead. The angle of the electrode should be 45° from horizontal and leading away from the weld at a 30° angle. The purpose of the long lead angle is to keep the slag from getting ahead of the arc. If the slag runs ahead, the re-fusion that occurs when the arc passes over it makes the subsequent removal of slag from the finished bead very difficult.

"Travel speed is maintained so the arc is ¼ to ⅜ in. ahead of the puddle."

Manufacturer E: No comment.

Manufacturer F: "You may quote us on this statement:

"Powdered-metal electrodes are definitely beyond the novelty stage and have a real place in the welding shops where increased production is necessary without the associated high-quality weldments normally expected with successful E-6020 applications. Since the bulk of mild-steel electrodes in use in industry today is of the E-6012 type, it would appear as though 35% of the welding done today can be accomplished with the new powdered-metal electrodes at great savings to the welding engineers and customers using the new product."

Manufacturer G: "We think a very important point you should bring out is the high deposition rate, which saves welding time and reduces overall welding costs."

Acknowledgments

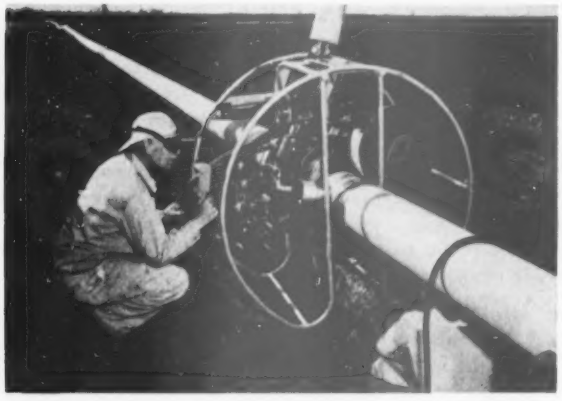
WELDING ENGINEER wishes to express its gratitude to the following manufacturers:

Air Reduction Sales Co., General Electric Co., Harnischfeger Corp., The Hobart Brothers Co., The Lincoln Electric Co., Metal & Thermit Corp., A. O. Smith Corp.

The order in which the manufacturers are listed in the above paragraph is not the same order in which they are referred to in the text as A, B, C, D, etc.

1—TWO men carry the 40-ft pipe lengths from truck

2—BUMPER jacks hold pipes level for tack welding



3—QUICK-ACTING clamps of automatic welder grip pipe

4—PIPE section is lowered in the ditch and buried

New aluminum pipe welder

BY G. W. BIRDSALL
Reynolds Metals Co.

As previously reported in Welding Engineer (August, 1953; May, 1954), a portable automatic welding machine has been developed for aluminum pipelines. It can join two 40-ft lengths of 8⅝-in. pipe in an average time of four minutes for a five-pass weld—half the time it would take to weld the pipes by hand. Because of its speed, the new machine is claimed to make aluminum pipelines competitive in cost with steel.

The portable automatic welder is a modification of the Mig or metal inert-gas process. It uses a consumable electrode of 43S aluminum wire and argon shielding gas with just a trace of helium. Representative welds tested have been found capable of withstanding hydrostatic pressures up to 1,800 psi.

In a 10-mile test installation, laid from the White Point gas field to the Reynolds Metals plant at La Quinta, Texas, the procedure was:

Pipe lengths were first coated and shop wrapped. (This is unnecessary in many instances.) Treatment included application of a primer, a bitumastic enamel, a fiberglass wrap, and Kraft paper wrapping over all.

After trucking to the field site, two men removed the lightweight sections from the truck (photo 1) and lined them up for welding. A 40-ft length weighs only 320 lb.

Standard bumper jacks were used to level the pipe. Joints were clamped in alignment and tack welded at three points around the circumference with a standard Tig welding gun (photo 2). Power for the hand gun and the automatic welding machine was supplied by a 300-amp d-c generator. Power for the controls was furnished by a 15-amp a-c light plant. Both plants were on trucks.

Tig (tungsten inert-gas) equipment was used for welding on flanges and fittings. This will not be the practice later on as improvement embodied in four newer models of the portable automatic welder will enable it to handle all operations.

Suspended over the line by a side boom, the welding machine gripped the pipe with quick-acting clamps (photo 3). Pressing of a button started the welding, and automatic controls maintained proper conditions at the arc. When a seam was completed, the machine stopped, reversed itself and returned to the starting position. The clamps were then released, and the machine moved to the next joint.

The weld was coated by hand and is electronically "jeeped" to locate minute holes. The holes are marked and repaired.

The welded sections were lowered into the ditch and buried (photo 4). That's all there is to it.

SPECIFICATIONS FOR COPPER AND COPPER–ALLOY WELDING ELECTRODES

Compiled from "Tentative Specifications for Copper and Copper-Alloy Welding Electrodes", ASTM designation B225-53T and AWS A5.6-53T.

Chemical Requirements

Common Name	Type, AWS ASTM Classification	Composition, %										
		Copper	Zinc	Tin	Manganese	Iron	Silicon	Nickel	Phosphorus	Aluminum	Lead	Total Others *
Copper	E Cu	98.0 †	*	1.0	0.5	*	0.50	*	0.15	0.01*	0.02*	0.50
Copper-silicon (Silicon bronze)	E CuSi	R	*	1.5[a]	1.5[a]	0.5	2.8-4.0	*	*	0.01*	0.02*	0.50
Copper-tin (Phosphor bronze)	E CuSn-A	R	*	4.8-5.8	*	*	*	*	0.15-0.35	0.01*	0.02*	0.50
	E CuSn-B	R	*	7.0-9.0	*	*	*	*	0.35	0.01*	0.02*	0.50
Copper-nickel	E CuNi	R	*	*	1.00	0.40-0.70	0.50	29.0 min.	0.0	N.S.	0.02*	0.50
Aluminum bronze	E CuAl-A1	R	0.20	N.S.	N.S.	N.S.	0.10	N.S.	N.S.	6.0-9.0	0.02	0.50
	E CuAl-A2	R	0.02	N.S.	N.S.	1.5	0.10	N.S.	N.S.	9.0-11.0	0.02	0.50
	E CuAl-B	R	0.02	N.S.	N.S.	3.0-4.25	0.10	N.S.	N.S.	11.0-12.0	0.02	0.50

Mechanical Requirements

Type	Tensile Strength, Minimum, Psi	Preheat and Interpass Temperatures, F		Standard Diameters, In.[b]	
		Minimum	Minimum	In Straight Lengths[c]	On Coils, Rims or Spools
E Cu	25,000	.....	.....		0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuSi	50,000	60	220	3/32, 1/8, 5/32, 3/16, 1/4	0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuSn-A	35,000	350	550	3/32, 1/8, 5/32, 3/16, 1/4	0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuSn-B	40,000	350	550	3/32, 1/8, 5/32, 3/16, 1/4	0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuNi	50,000	60	220	3/32, 1/8, 5/32, 3/16, 1/4	0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuAl-A1	55,000	300	400	.....	0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuAl-A2	60,000	300	400	3/32, 1/8, 5/32, 3/16, 1/4	0.035, 0.045, 1/16, 5/64, 3/32, 1/8
E CuAl-B	65,000	300	400	1/8, 5/32, 3/16, 1/4	

NOTES

* Total other elements, including those marked (*), shall not exceed the value specified.

† Minimum, including silver for E Cu.

N.S. – Not specified.

R – Remainder.

[a] One or both of these elements may be present within the limits specified.

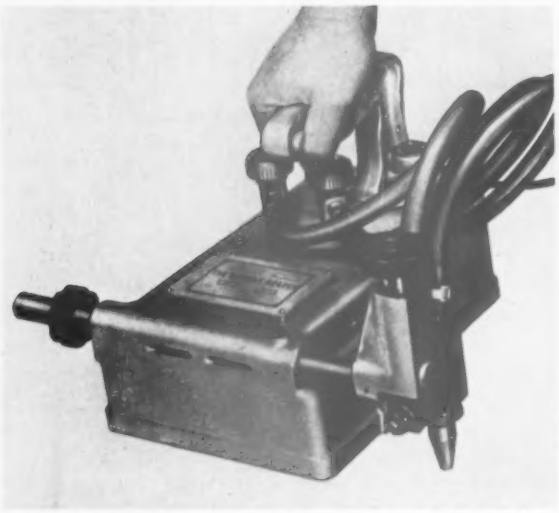
[b] Diameter of electrode (core wire for coated electrodes) shall not vary more than the following from nominal: 0.035 in. ±0.0007 in., 0.045 in., ±0.0008 in., 1/16 and 5/64 in., 0.0015 in., 3/32 in. and larger 0.002 in.

[c] Standard lengths of coated electrodes shall not vary more than 3/16 in. from nominal and shall be: 9 and 11 in. for 3/32 in., 14 in. for 1/8, 5/32 and 3/16 and 18 in. for 1/4, 3/16 and 3/8 in.

Standard packages for coated electrodes shall be 10, 25 and 50 lb. Coils, 25 lb min net weight.

The specifications also prescribe mechanical tests to demonstrate properties, soundness and ductility of the deposited metal. These include a transverse tension test for mechanical properties and a guided-bend test for soundness and ductility of the weld metal.

new products . . . . . USE CARD ON PAGE 65



CUTTING machine is light in weight, easily portable

STEPLESS current control is feature of new welder

Portable flame-cutter

50 SIMPLICITY of operation is one of the features claimed for the "Beaver" portable flame-cutting machine. It will cut in a straight line or bevel, cut circles and shapes with equal ease, according to manufacturer. Cutting range is from 1/8 in. to 4 in. Power source is a 110-volt, 60-cycle motor.

For greater flexibility, torch racks can be adjusted on vertical and horizontal planes. All controls for oxyacetylene and power are conveniently located for quick, one-hand operation—adjustments can be made without stopping machine. Cutting torch is said to work equally well on oxypropane. Standard cutting tips may be used. Driving mechanism comprises governor, motor and gear box.

THE BURDETT OXYGEN CO.

* * *

Solder and flux

51 ALL-PURPOSE hard solder and flux, called respectively, "Weldalloy" and "Weldaflux," are said to simplify aluminum soldering. Manufacturer claims the combination easily solders aluminum to brass, both to stainless steel and copper, and almost all metals each to the other.

TIP TOP ELECTRIC PRODUCTS CO.

* * *

Spot welder

52 DESIGNATED "SP1," newly designed air-operated, press-type, low-impedance single-phase spot welder can be supplied with throat depths from 18 to 42 in. It has an electrode force of 1,000 to 1,575 lb maximum, depending upon throat depth.

Manufacturer claims the "SP1" will make high-quality welds on large production runs on wide range of gages of clean mild steel and stainless steel. By varying weld time, weld current and electrode force, even heavier gages can be joined at slower speeds.

SCIAKY BROS., INC.

* * *

Electrode

53 IRON-powder-coated electrode, "Jetweld 2 HT," is especially designed for high-speed welding of flat-fillet and deep-groove joints where high tensile strength and low crack sensitivity are required. It operates on either a-c or d-c, with the former preferred. Typical stress-relieved values: tensile, 76,700, psi; yield, 64,300 psi; elongation, 27%. The new electrode is classified as an E-7020 and is 7/32 in. in diameter.

THE LINCOLN ELECTRIC CO.

* * *

Pneumatic chipper

54 IMPROVED pneumatic chipper for cleaning welded seams can develop 5,300 blows per minute. Its weight has been lowered to make handling easier. Exhaust air is directed forward against the workpiece, so that chips are blown away continuously, permitting constant check on work without interruption.

COPCO EASTERN.

—McGraw-Hill World News

A-c welders

55 COMPLETE new industrial line of low-maintenance, a-c welders is for high-speed production applications. Available in NEMA-rated 300, 400 and 500-amp models, the welders feature stepless current control, silicone insulation, aluminum coil windings and are equipped with a large current scale, which can be read from a considerable distance, manufacturer states.

Highly accurate current adjustments are accomplished by raising and lowering the primary coil, it is claimed. Current ranges: 38 to 375 amp on the 300-amp models ("6WK30L"); 52 to 500 on the 400-amp ("6WK40L"); 65 to 625 on the 500-amp model ("6WK50L"). The welders are available for 220/440 or 550-volt operation.

GENERAL ELECTRIC CO.

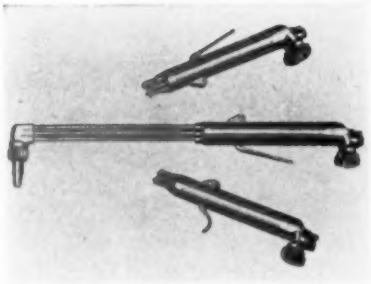
* * *

Index table

56 HIGH-speed index table, "Intermittor," is designed to permit passage of air or hydraulic fluid through roller gear shaft and dial to the work area for actuation of product-holding devices, or cooling water for dissipation of heat in operations such as induction welding.

Standard tables are now available with 4, 6, 8 or 12 stops with dial sizes varying from 12 in. to 36 in. in diameter. Variations in movement time range from one-quarter to three-quarters of the total cycle.

FERGUSON MACHINE & TOOL CO.



Cutting torch

57 LIGHTWEIGHT gas cutting torch has three-in-one handle that can be rotated to accommodate a cutting jet lever in either underhandle or overhandle position. A trigger can be installed in the former location.

Said to be capable of heavy cutting, the torch has newly designed "slip-in" tips that are seated in the head with hand pressure on tip nut; no wrench is necessary. Cutting valve seat is easily replaceable without dismantling torch.

Available in head angles of 75 and 90 deg. Two-hose and three-hose models for use in automatic cutting machines are also available.

SMITH WELDING EQUIPMENT CORP.

* * *

Electronic timer

58 GENERAL-purpose electronic timer for interval timing, timed delay, repeat cycling, programming or pulsing is said to be accurate to within 1%. The "T2" timer is designed for use on induction-heating equipment, process timing, sequence control of automated equipment, etc.

FERRARA, INC.

* * *

Grinding disc

59 DESIGNED for heavy weld removal and rough grinding, depressed-center abrasive disc is said to combine increased cutting ability and safety. Called the "3M Type G," it is made of aluminum-oxide mineral in a reinforced fabric-and-resin construction. It can be also used for slotting and portable cut-off operations. Available in grit 24 in two sizes—7 and 9⅛ in. Speed of 5,500 rpm is recommended for larger size, 6,000 rpm for smaller. Disc has a ⅞-in. arbor, overall thickness of ¼ in.

MINNESOTA MINING AND MFG. CO.

* * *

A-c welder

60 HEAVY-duty welder for wide range of a-c production jobs is available in 300, 400 and 500-amp sizes. Designated the "SLP," it has no moving parts; core and coils are anchored in place for quiet and trouble-free operation, according to manufacturer. Transformer is of shell-type design, using "Saturable Leakage Path" control for adjustment of welding current.

Extra secondary winding supplies current to control rectifier, which is of standard selenium type—40 volts d-c for safe, low-voltage remote control. Light and heavy metals can be welded with same machine.

HOBART BROTHERS CO.

* * *

Control equipment

61 ELECTRONIC control equipment for resistance-welding applications is known as "Tempomat Series P.E. 5000." It is available in four cabinet sizes, depending upon complexity of welding program cycle to be controlled. Combinations of a range of units, within six standard panels, permit building up of 180 different arrangements of welding sequence to cover every possible welding requirement, it is claimed.

The "Tempomat" can be used with all types of spot, seam and projection welding machines.

PHILIPS ELECTRICAL LTD.

—McGraw-Hill World News

Portable gas welder

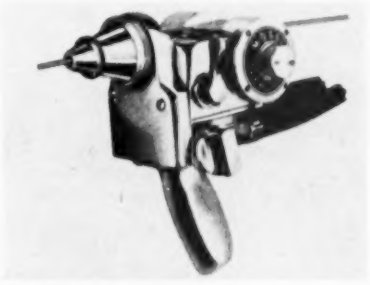
62 WORKING in conjunction with Harvey Aluminum, Torrance, Calif., this firm has developed portable welding unit for light gas welding, which can be used on all commercial aluminum alloys.

Unit consists of full 80-cu-ft oxygen cylinder (73 lb), a full B acetylene cylinder (35 lb), and the accessory group comprising torch and tips, regulators, twin hose, goggles, wrench and file lighter (combined weight, 17 lb). Additional equipment is optional.

Welding unit is especially recommended for building contractors, structural workers, field welding, electrical contractors, etc.

BURDETT OXYGEN CO. OF CALIFORNIA.

* * *



Metallizing gun

63 WEIGHING only 5½ lb, new metallizing gun can be used in a tool post or be operated by hand. "Turbo-Jet" has been designed to spray an extremely fine, dense coating, using wire from 20 gage to 3/16-in. diameter and from the highest melting point molybdenum to the lowest melting point wires.

The gun will operate on acetylene, propane or natural gas of 15 psi. Magnetic-controlled governor using 60 psi air gives wire-speed range from 2½ ipm to 20 fpm.

METALLIZING CO. OF AMERICA.

(Continued on page 70)

free literature..... USE CARD ON OPPOSITE PAGE

1 PORTABLE FLAME-CUTTER — The Burdett Oxygen Co. Forms 854 and 854-A tell of the "Beaver," a portable flame-cutting machine that is said to cut up to 4 in. with ease. Specifications, instructions and illustrations are included.

2 CYLINDER MANIFOLDS—National Welding Equipment Co. Pages 6 through 15, Section 8, of "National Notes" contain detailed and illustrated explanation of this firm's "Compound Pressure" cylinder manifold design.

3 METAL CLEANING—Oakite Products, Inc. "Some good things to know about Metal Cleaning" is 44-page illustrated booklet that lists various methods for different metals.

4 HAND TORCHES — Air Reduction Sales Co. 36-page catalog (ADC 702B) covers firm's complete line of torches and tips for oxyacetylene welding and cutting. Also listed are necessary mixers, extensions, adapters and accessories. Includes illustrations, charts and descriptions.

5 WELDING DATA—Glenn Co. Factual data on principle of constant-voltage power supply and its application to inert-gas, submerged-arc and other automatic welding processes is given in series of data sheets. Included is a report on such control for automatic metal-arc welding.

6 WELDING GENERATOR—Hobart Brothers Co. Data Sheet A-420-g gives specifications of generator of firm's combination a-c arc welder and a-c power plant. The firm is now offering the generator only (less engine) so users can apply their own power source.

7 WELDING, CUTTING — The K-G Equipment Co. (Inc.) Abbreviated catalog—No. Q54E—pictures and describes welding and cutting torches and regulators.

8 RESISTANCE WELDING—The Federal Machine and Welder Co. Some of this company's resistance-welding equipment used in the steel-making industry is pictured in Vol. 1, No. 4 of "Tips and Dies."

9 NICKEL STEELS—The International Nickel Co., Inc. Bulletin A-68 is 36-page booklet entitled "Tensile and Impact Properties of Quenched and Tempered Nickel Alloy Steels in Different Sizes." More than 70 charts show mechanical properties that can be expected in various section sizes.

10 TIG WELDING — Sylvania Electric Products, Inc. New folder provides information on tungsten welding electrodes and inert-gas welding techniques. Use of argon instead of helium is suggested as one method of overcoming problem of difficult starting or low voltage in a welding operation.

11 STEEL ALLOY — United States Steel Corp. "U. S. Steel presents T-1" is title of 46-page, profusely illustrated booklet on "Carriloy T-1" steel, a new alloy that was described in last month's WELDING ENGINEER.

12 DUAL-HEAD WELDER — Universal Welder Corp. New dual-head resistance-welding machines that maintain two complete setups with instantaneous change-over are described in Bulletin 10905. It delineates typical combinations of seam, roll-spot and projection welding, which are accommodated by these machines.

13 HARDFACING DATA — Mir-O-Col Alloy Co. 72-page, pocket-size brochure contains comprehensive and analytical study of hardfacing, its application and its wear-resisting qualities wherever impact and abrasive conditions exist.

14 METAL PROTECTION—Solar Aircraft Co. 8-page booklet contains series of case histories showing how ceramic coatings have solved metal-service problems. "Solaramic" coatings are designed to protect high or low-alloy steel fabrications from heat or corrosion.

15 CONTROL VALVES—Ross Operating Valve Co. Three fundamental types of air control valves are described and illustrated in new 4-color, 12-page booklet, Bulletin 101B. The basic models: integral pilot operated, remote controlled, direct operated.

16 ARC WELDERS—The Lincoln Electric Co. Bulletin 1337 is four-page brochure illustrating and describing firm's "Shield-Arc" engine-driven welders used in structural and pipeline work. Specifications and diagrams of these industrial d-c welders are included.

17 VAPOR COLLECTOR — Aget Detroit Co. Bulletin 640 No. 3 shows how mist from group of centerless grinders is controlled by individual unit-type vapor collectors that are suspended from ceiling of shop.

18 POWDER METALLURGY—The National Radiator Co. Bulletin No. 1 provides brief introduction to art of powder metallurgy. Leaflet includes reference to major uses of metal powders such as in welding rods, cutting tools, flame-cutting and chemical applications.

19 VALVES — Numatics Operating Valve. 8-page brochure pictures and describes new line of solenoid-controlled, pilot-operated or remote air pilot-controlled valves. These two- and three-way valves come in sizes of ¼, ⅜, ½, ¾ and 1 in.

20 GRINDING WHEELS—Norton Co. Catalog 1052 is new condensed booklet that covers grinding-wheel selection in detail. Included in the 28-page illustrated catalog is a supplement of net prices to customer in various quantity lots. Includes specifications, applications.

21 PRESSURE WELDING — Utica Drop Forge & Tool Corp. 6-page folder lists general information on "Koldweld," a process of pressure welding. Depicted are tools used for butt and lap welding, which make real welds, not just bonds, according to manufacturer.

22 ALUMINUM — Kaiser Aluminum & Chemical Sales, Inc. Handy wall chart shows new designation system for wrought aluminum and wrought-aluminum alloys. New four-digit system, developed by Aluminum Association, became effective Oct. 1 of this year.

23 MAINTENANCE — General Electric Co. "Five Steps to Productive Maintenance" is title of 18-page bulletin (GEA-6087) that provides detailed information on organizing to meet demands that automation will make on electrical maintenance programs.

24 SPOT WELDING—The Taylor Winfield Corp. No. 547 of "Weld-It" describes application of firm's spot welders in welding aluminum die castings in plant of vacuum-cleaner manufacturer.

25 RESISTANCE WELDING — Sciaky Bros., Inc. Vol. 3, No. 7 of "Resistance Welding at Work" covers case history of this firm's welding equipment as used by a manufacturer of transformers.

26 SAFETY CLOTHING—Pulmosan Safety Equipment Corp. New and complete clothing booklet describes full line of asbestos gloves and mittens, chrome-leather aprons, welding jackets, gloves.

27 WASTE PREVENTION — Kelly-Read & Co., Inc. Multicolor poster, 20 by 27 in., is entitled "Don't Waste Them" and is for use in helping industry condition employee attitudes against wasting time, materials and machines.

28 SOLDERING UNITS — Vemaline Products Co. Leaflet illustrates and describes two models of precision-soldering instruments that have adjustable heat control.

29 AIRLESS BLASTER — American Wheelabrator & Equipment Corp. Bulletin 944 describes new table-type airless blasting machine. The 72-in. "Swing Table" requires no pit for abrasive hopper. Work table comes out of machine for easy loading.

30 GLOVES—Advance Glove Mfg. Co. Various types of industrial gloves and their prices are shown in 4-page brochure.

31 WELDING PRODUCTS—American Brake Shoe Co. Included in this 48-page catalog of industrial products are sections on welding products, air compressors, steel forgings and ferrous and non-ferrous castings. It's the firm's first complete catalog.

WELDING INFO-AIDS

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MUREX ELECTRODES • ARC WELDERS • ACCESSORIES

No single electrode is best

Job-match

A.O.Smith SW-11

A.O.Smith SW-12

A.O.Smith SW-17

SW-11

Here's a "cold" E-6012. Designed for all position welding with minimum penetration, maximum throat thickness. Performance is exceptional when fit-up is poor . . . bridges over, won't burn through. Operates much better on A.C. than ordinary E-6012 electrodes. Widely used for truck bodies, farm machinery, foundry equipment, storage tanks, etc.

for every job in AWS Class E-6012

your electrodes with A. O. Smith's BIG THREE

BECAUSE welding is A. O. Smith's *full-time* business — because we constantly use every type of welding electrode right in our own shops — we know this for a fact:

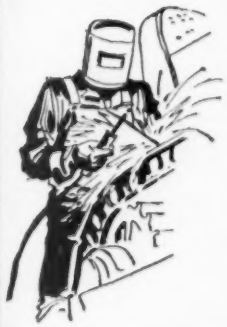
You can't handle every job in AWS Class E-6012 with just one electrode. There's no one-shot cure-all!

That's why we give you the BIG THREE — three fine electrodes, each tailored to deliver top performance on different Class E-6012 jobs.

A. O. Smith's BIG THREE lets you job-match your electrodes . . . helps you pick the one that's exactly right for your particular operation.

Check the details in this ad. Then, see your A. O. Smith distributor . . . or write direct. A. O. Smith Corporation, Welding Products Division, Milwaukee 1, Wisconsin.

SW-12 This is a "hot" E-6012 . . . versatile, smooth and fast. Designed for applications where the upper end of the amperage range is employed. Weld deposition is much faster than with SW-11. Welder can hold a close arc without sticking. SW-12 also works well where fit-up is poor . . . bridges across, assures a good weld and won't penetrate through.



SW-17 A "hot" E-6012, can take from 30-40 more amperes than others. A general purpose high rutile type electrode for heavy production welding, where fit-up is poor and high ductility and mechanical properties are desired. Built-in toughness is one outstanding characteristic. Deposition is extremely fast, physicals are excellent. It is highly recommended for horizontal single pass fillet work.

Produced by welders for welders

Because welding is our full-time business, we offer you the top line of welder-proved equipment and accessories. Everything from a-c and d-c welding machines to helmets and cleaning tools.

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A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

Inside Information proves

Gasweld

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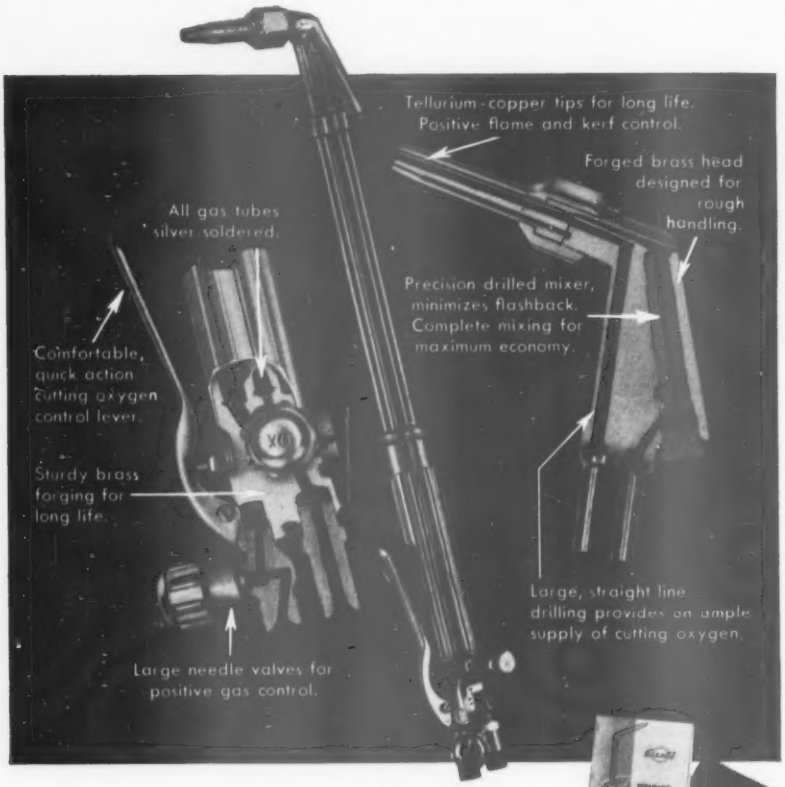
The cutaway views show a few of the many fine features built into each piece of GASWELD equipment.

Featherlite or extra heavy duty — there's a GASWELD cutting or welding torch that will meet *your* needs perfectly.

Prove it to yourself — try a GASWELD torch today!


Tellurium-copper tips for long life. Positive flame and kerf control.
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Liquid THE LIQUID CARBONIC CORPORATION

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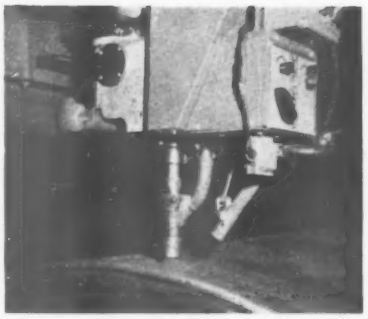
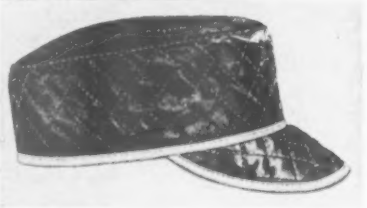


Flux dispenser

64 SPECIAL nozzle and flux-dispensing assembly for "Lincolnweld" automatic submerged-arc welding heads is said to cut in half the amount of flux being handled. Other major features claimed for the unit: better following of irregular seams and limiting flux feed to exact area of the weld (thus the reduction in flux flow).

AUTOMATIC WELDING CO.

* * *



Weldor's cap

65 DANGER of stray sparks igniting weldor's cap is sharply reduced in a new cap made of fire-retardant fabric, according to manufacturer. It resembles the conventional soft quilted black weldor's cap in most respects; however, the fabric is quilted with red nylon thread of extra strength and has a red binding at the bottom edge.

LOUISVILLE CAP CO.

* * *

Thyratron tube

66 DESIGNED especially for motor speed control and low current regulated voltage supplies is the industrial thyratron tube "NL-716." It is rated at 1 amp d-c and 8 amp peak current. It is gas and mercury filled for quick starting and long life. Other ratings: filament voltage, 2.5 volts; filament current, 6.3 amp; peak forward and peak inverse voltage, 1,250 volts.

NATIONAL ELECTRONICS, INC.

For more information use card on page 65

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WELDING ARCS NEWS

LONG-LIFE WELDERS ASSURED BY MODERN TESTING AT NEW G-E PLANT

NEW, EXPANDED G-E PLANT at York, Pa., devotes modern manufacturing-testing-facilities to new standards in arc-welding equipment. New G-E a-c welders undergo extensive quality controls . . .

PERFORMANCE TESTING of new a-c welder backs up long-life span. Every phase of operation is checked before the welder is released for production.

G.E. announces a NEW line of long-life a-c transformer welders

life-span increased with new design and materials—backed up by exacting quality controls, including 20 life-tests, 21 inspections

From its new, expanded manufacturing plant at York, Pa., General Electric now brings you industry's most modern line of a-c transformer welders. Available in 300-, 400-, and 500-amp models for indoor and outdoor service—this new equipment features improved design, new materials, and will give long, dependable service.

MOVING-COIL DESIGN REDUCES WEAR and vibration normal to other types of welder design. No moving magnetic parts are used. This low-maintenance design also furnishes accurate pinpointing of current settings for real welding precision.

IMPROVED AUTOMATIC "HOT-START" gives you the advantage of instant arc striking throughout the current range. Now you can be sure of quick starts even at the low end of the range.

PROTECTION AGAINST OVERHEATING DAMAGE caused by short-time overloads is provided by silicone insulation on aluminum-wound coils. This insulator stands up against overload temperatures which disintegrate ordinary varnishes.

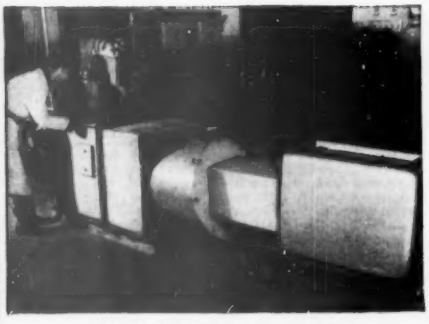
NEW ALUMINUM WINDINGS are used on transformer coils for reliable service, even under highly critical conditions.

REMOVABLE SIDE COVERS, OPEN CONSTRUCTION speed servicing. Each side cover of the G-E a-c welder can be removed quickly by simply taking out three screws.

EVEN QUIETER OPERATION than normal for a-c welders is achieved by a special vibration-insulating mount for coil supports. The moving primary coil virtually "floats," with a minimum of friction, vibration, and fatiguing noise.

IMPROVING ON EASY-TO-HANDLE ARC inherent to a-c equipment, the new G-E transformer welder provides arc stabilizing capacitors. The result is an unusually steady arc, which can be manipulated easily for faster travel speeds and increased production.

ASK YOUR G-E WELDING DISTRIBUTOR today for bulletin GEA-6243 for full details on the new long-life a-c welders. You will find his name and address in the yellow pages of your phone book, and on the next page. See this new G-E welder at the National Metals Exposition at Chicago in November. General Electric Co., Schenectady, N. Y. 710-20



PROPER COOLING OF EQUIPMENT, essential for dependable service, is checked in air-flow test, which determines the amount of air moving through welder.

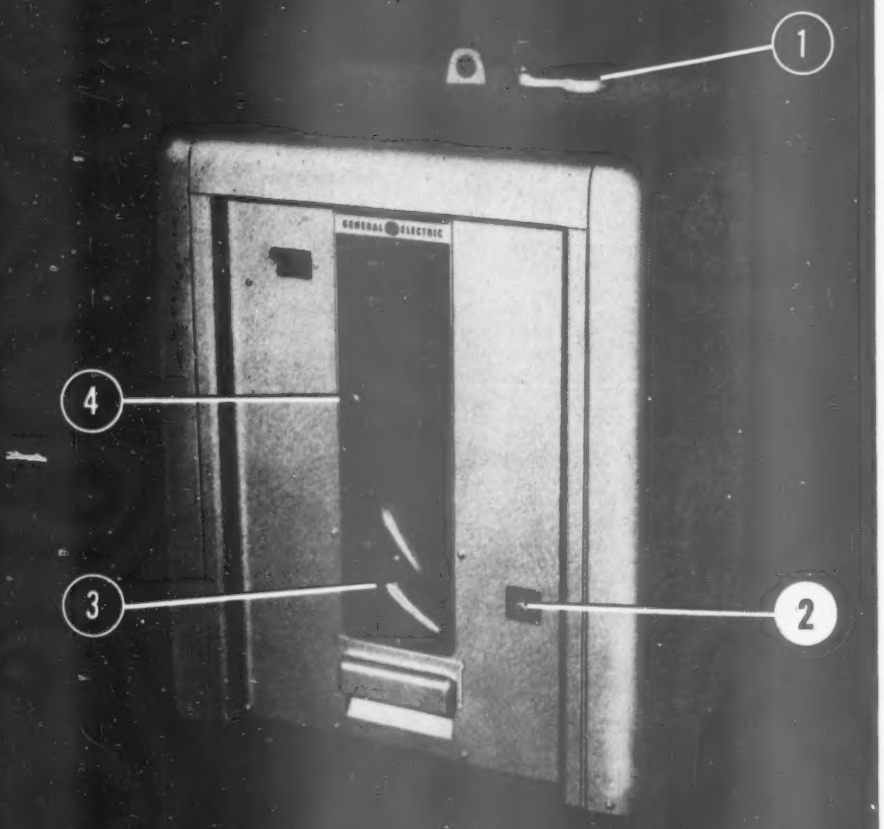
SIX TIMES RATED VOLTAGE is applied to primary coil for fifteen seconds, in testing of new a-c welder. This test assures high safety factor for silicone insulation which is used on all coil windings.

	General Electric	Company A	Company B	Company C
Moving Coil Design	✓			✓
Aluminum Windings	✓	✓		
Silicone Insulation	✓			
Hot Start	✓	✓	✓	
Arc-Stabilizing Capacitors	✓	✓		
Large Logarithmic Current Scale	✓			✓

COMPARISON WITH OTHER MAKES shows you that the new G-E a-c welder is your best buy. For more G-E welding news, turn page . . .

GENERAL ELECTRIC

NEW G-E 300-amp rectifier welder offers full-time arc-force control



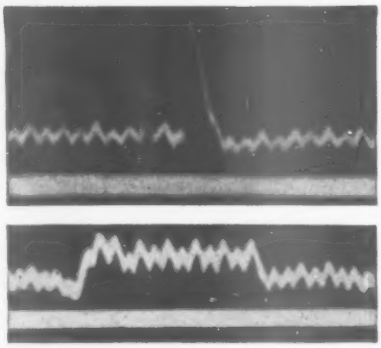
NEW G-E 300-amp rectifier welder offers *full-time* arc-force control . . . and many improved features, including—

1 **FINGERTIP-ADJUSTABLE MOVING COIL:** provides stepless current control for pinpoint accuracy, reduced wear and vibration. Current range is wide—20–375 amps.

2 **ARC-FORCE CONTROL IS FULL TIME:** doesn't cut out in the middle of an electrode. High arc force blasts away short-circuiting metal droplets, which ordinarily freeze short arcs. Results—unusual arc stability, deep penetration, and easy maneuvering.

3 **REVERSING POLARITY SWITCH:** conveniently mounted for instant changing from straight to reverse polarity.

4 **SPRING-LOADED CLEANOUT SWITCH** reverses ventilating fan for blowing dust off rectifiers—prolongs equipment life. Write your G-E welding distributor for bulletin GEA-6242.



SUSTAINED SHORT CIRCUIT occurs without arc-force control (lower oscillogram). Metal cools, electrode freezes. With *full-time* G-E arc-force control (upper), metal is blasted away, short circuit is brief.

Contact Your G-E Welding Distributor Today

Alabama: Birmingham—Alabama Oxygen, Young & Vann Supply; Mobile—Turner Supply

Arizona: Phoenix—Consolidated Welding Supply

California: Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, Ventura—Victor Equipment

Colorado: Boulder, Colorado Springs, Denver, Durango, Ft. Collins, Ft. Morgan, Greeley, LaJunta, Longmont, Pueblo, Sterling—Hendrie & Bolthoff

Connecticut: Hartford, New Haven—Harris Company

Florida: Hollywood—Florida Gas & Chemical

Georgia: Athens—Welding Gas Products; Atlanta, Macon—Welding Supply & Service; Augusta—Marks Oxygen; Columbus—Williams Welding Supplies; Gainesville—Welding Gas Products

Idaho: Boise—Gate City Steel

Illinois: Chicago, Moline, Morton, Rockford—Machinery & Welder

Indiana: Evansville—Drillmaster Supply; Ft. Wayne, Indianapolis—Sutton-Garten; South Bend—PerryWelding Sales & Service

Iowa: Des Moines—Machinery & Welder

Kansas: Wichita—Standard Products

Kentucky: Louisville—Reliable Welding; Paducah—Henry A. Petter Supply

Louisiana: Alexandria, Shreveport—Hughes Oxygen; New Orleans—Consolidated Welding Supplies

Maryland: Baltimore—Arcway Equipment

Massachusetts: Boston—New England G-E Welding Sales Division

Michigan: Detroit—Welding Sales & Engineering; Grand Rapids—Miller Welding Supply

Minnesota: Duluth—W.P.&R.S. Mars; St. Paul—Production Materials

Mississippi: Jackson—Jackson Welding & Supply

Missouri: Kansas City—Hohenschild Welders Supply; St. Louis—Machinery & Welder

Montana: Billings—Valley Welders Supply; Billings, Bozeman, Cut Bank, Glasgow, Great Falls, Havre, Kalispell, Miles City, Shelby, Sidney, Whitefish—Valley Motor Supply; Butte, Great Falls—Montana Hardware

Nebraska: Lincoln—Lincoln Welding & Supply; Omaha—Baum Iron

New Jersey: Kenilworth—Welding Sales Corp.

New Mexico: Albuquerque—Industrial Supply Co.; Hobbs—Western Oxygen; Las Cruces, Silver City—Car Parts Depot, Inc.

New York: Buffalo—Welding Equipment Sales; New York—Welding Sales Corp.; Syracuse—Welding Engineering & Equipment

North Carolina: Charlotte—Dixie Gases; Gastonia—Gastonia Motor Parts

North Dakota: Bismarck, Fargo—Acme Welding Supply

Ohio: Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield—Burdett Oxygen; Toledo—Odland Iron Works

Oklahoma: Oklahoma City—Hooper Supply; Tulsa—G-E Welding Sales Division

Oregon: Eugene, Portland—J. E. Haseltine; Medford, Portland—Industrial Air Products

Pennsylvania: Allentown, Philadelphia, Pittsburgh—Arcway Equipment

South Carolina: Columbia, Greenville—Welding Gas Products

South Dakota: Deadwood—Hendrie & Bolthoff

Tennessee: Chattanooga, Knoxville, Nashville—Welding Gas Products; Memphis—Delta Oxygen

Texas: Abilene—M&M Welding Supply; Alice, Corpus Christi—Crane Welding Supply; Alpine, El Paso, Marfa, Pecos—Car Parts Depot; Amarillo—Welding Equipment & Supply; Beaumont—H. & W. Welding Supply; Brownsville, Harlingen—Acetylene Oxygen; Dallas—Hill Equipment & Supply; Houston—G-E Welding Sales Division; Lubbock—Welders Supply of Lubbock; Midland—West Texas Welders Supply; Odessa, Pecos—Western Oxygen; Orange—Marine & Petroleum Supply; Pecos—Welding Supply Co.; Plainview—Plains Welding Supply; San Angelo—Southwestern Welding Supply; Texarkana—Hughes Oxygen; Wichita Falls—McGinnis Welding Supply

Utah: Salt Lake City—The Galigher Co.

Washington: Seattle, Spokane—J. E. Haseltine; Seattle, Spokane, Yakima—Industrial Air Products

West Virginia: Bluefield—Bluefield Supply; Charleston—Virginian Electric; Huntington, Logan—Logan Hardware & Supply

Wisconsin: Milwaukee—Machinery & Welder

Wyoming: Cody, Lovell—Valley Motor Supply Co.

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GENERAL ELECTRIC

Next Steps in Atomic Progress... A Challenge to American Industry

The purpose of this editorial is to throw light on the significance for American industry of recent changes in the statutes that control the development of atomic energy.

The need for clear light on the meaning of this new legislation is made more urgent by the political confusion and distortion that marked its course through Congress. The politically inspired charges of "giveaway" that delayed its passage—charges that were almost totally unrelated to the legislation itself—helped to obscure the vital importance of the step finally taken by Congress.

In sober, post-Congressional fact, the principal significance of the new atomic legislation is that it extends to private enterprise responsibility for the development of peaceful uses of atomic energy, whereas heretofore this responsibility has rested in a tight government monopoly. **And this extension is made on terms that emphasize the responsibility far more than they open any opportunity for economic gain in fulfilling it.** The revised Atomic Energy Act provides that:

1. Industry may now own and operate its own nuclear reactors, under license from the Atomic Energy Commission. And it may build and sell nuclear reactors for export.

2. Industry may use—but not own—nuclear materials at the discretion of the Atomic Energy Commission.

3. The Atomic Energy Commission will make available to industry scientific knowledge that may be useful in developing peaceful applications of nuclear energy.

4. For the first time, industry will have the right to patent inventions in the field of nonmilitary nuclear energy. However, "basic" discoveries must be made available to all companies in the field for a period of five years, after which they, too, will revert to normal patent status.

Two Kinds of Know-How

These provisions, despite the imposed limitations, represent the first positive step toward development of nuclear energy for peaceful applications in the United States. Potentially useful knowledge, previously locked in the minds of government scientists, will now be available to all those who are willing and able to put it to work for the good of mankind.

The advantages to be gained from enlisting the talents of American industry in the development of peaceful atomic applications are imposing. As *The* (London) *Economist*, Europe's leading economic journal, recently remarked, "The atomic scientists are in a position to surmise how atomic energy can be applied... but they lack the specialized knowledge of engineering design and operating technique just as industry itself lacks atomic knowledge." Now the engineers of private industry need no longer lack the atomic knowledge, and there is granted to them at least a restricted freedom to apply it to the solution of their engineering and operating problems.

But the new opportunity for private industry to find constructive uses for the science of nucleonics carries with it a grave responsibility. These uses must be so developed that they will benefit the people of all the free nations. It is essential that the United States, which pioneered in developing lethal uses for atomic fission, demonstrate to the world our paramount interest in its peaceful application. It would be a moral set-back to the free world almost beyond calculation if the Communists should be able to offer to the poorer nations of the world the benefit of low cost atomic power—provided by Communist technicians—while we concentrate primarily on building our stockpile of atomic and hydrogen bombs.

Race For a Peaceful Victory

Most of the experts are agreed that it may be many years—perhaps ten, fifteen or more—before the cost of electricity from atomic fission can be reduced to a level that will make it competitive with conventionally produced power in most regions of the United States. But most of the world is not nearly so fortunate as we are in power resources. Electricity, even at a cost far higher than the average that prevails in the United States, would be a blessing in many countries, and the nation that provides the technology to bring it into being will score a great moral victory.

The useful potential of nuclear energy is not restricted to the generation of electric power—although twenty years from now this use will be highly important to the power industry of the United States. Even with the limited research that has been done in this field thus far, the use of radioisotopes—the radioactive products of atomic reactors—is saving American industry an estimated $100 million a year. Commissioner Campbell of the AEC, who made this estimate, believes that these savings may well reach $1 billion a year within ten years. Radioisotopes are already at work in industries ranging all the way from paper manufacturing, where they measure paper thickness, to pipeline transportation, where they mark the dividing lines between shipments of different products (at an estimated saving of $500,000 a year). Medical applications of these same radioisotopes hold promise of longer and more comfortable lives for those who are stricken by cancer and other diseases.

Above All a Challenge

The new Atomic Energy Act is a crucial stride toward the day when all these benefits—and undoubtedly others not yet revealed by research—will be realized. But it is a step that is essentially permissive. It still leaves it to private industry for the most part to decide what is to be done and how soon.

The new act is thus, above all, a challenge. It confers on private industry the responsibility to assume a leading role in the development of peaceful uses for nuclear energy, a step long urged by NUCLEONICS, a McGraw-Hill magazine devoted to atomic energy. To achieve a success in this task that will measure up to the requirement of the national interest, this development must command all the resources and ingenuity that private enterprise can apply—and do so without promise of glittering prizes surely to be won. **But now that the responsibility has been defined and the challenge offered, American industry will, we believe, measure up to its grave and mighty import.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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AO COVERGLAS GOGGLES

Fit Over Safety
And Personal Glasses

NEW
Safety
Goggles

#326

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NEW — 4 WAYS!

1. New Cup Size and Shape
2. New Lens Size and Shape
3. New Side Shields
4. New Easy Lens Replacement

AO's newest development in eye protection—Chippers' and Welders' Coverglas Goggles—can be worn over practically every pair of personal glasses (even the biggest frames) and most types of safety prescription goggles *with and without side shield.*

Wider vision, too, because the lenses are larger and scientifically designed to give up to 20% more vision. Yet, with all these features the goggles weigh but a fraction of an ounce more than ordinary Coverglas goggles . . . cost only slightly more.

These goggles are the newest . . . and two of the greatest . . . developments since the advent of safety goggles. Get all the facts about these two outstanding Coverglas goggles from your AO Safety Products Representative. He can supply you.

QUICK FACTS

- Lens easily replaceable from rear (not front) by means of a spring clamp—no tools needed
- Lightweight, brown plastic cups fit face snugly, won't conduct heat or electricity
- Light-tight side shields for welders (on No. 327 goggle) provide indirect ventilation
- Bridge—High-grade leather. Instant adjustment
- AO worker-lab tests show much greater field of vision and increased comfort
- All-rubber headband, easily adjustable

"326" Chippers' Coverglas goggle supplied with regular Super Armorplate lenses. "327" Welders' Coverglas goggle supplied with regular Noviweld lenses and cover lenses.

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SAFETY PRODUCTS DIVISION

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Q: Isn't all filler metal for consumable electrode welding about the same?

A: No indeed—it's the quality of the filler metal that controls the quality of the weld.

Q: How can you be sure of getting the best electrode?

A: By insisting on Alcoa's new I.G.* Electrode.

Q: Why?

A: Every production lot of Alcoa® I.G. Electrode is test welded and the welds X-rayed for soundness. Each 10-lb spool is individually packed to maintain the super-smooth finish to assure soundness of weld and smoothness of feed. Each of three alloys, 1100, 4043 and 5154 (formerly 2S, 43S and A54S), is available in six diameters. There is no better electrode.

*inert gas

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

A new, 176-page text, *Welding Alcoa Aluminum*, has just been released by Alcoa. It covers every phase of welding in complete detail. For a free copy, fill in and mail the coupon.

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Gentlemen: Please send book, *Welding Alcoa Aluminum*.

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Q: Where is Alcoa's new I.G. Electrode available?

A: Contact your nearest Alcoa sales office, or, for immediate delivery, call one of the Alcoa Distributors listed below. He carries a complete range of alloys and sizes and you'll find him well qualified to work with your welding experts.

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ROCHESTER, N. Y.
Brace-Mueller-Huntley, Inc.

ST. LOUIS, MO.
†Metal Goods Corp.

SALT LAKE CITY, UTAH
Pacific Metals Co., Ltd.

SAN DIEGO, CALIF.
Ducommun Metals & Supply Co.

SAN FRANCISCO, CALIF.
†Pacific Metals Co., Ltd.

SEATTLE, WASH.
Pacific Metal Co.

SYRACUSE, N. Y.
†Brace-Mueller-Huntley, Inc.
Whitehead Metal Products Co., Inc.

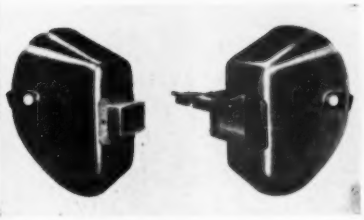
TAMPA, FLA.
†Florida Metals, Inc.

TOLEDO, OHIO
Williams & Co., Inc.

TULSA, OKLA.
Metal Goods Corp.

YORK, PA.
Edgcomb Steel Co.

†Home Office



Welding helmet

67 FIBER-glass welding helmets are made in a fixed-front type and lift-front type and feature the narrow-front shape. Manufacturer states real economy of fiber-glass helmets was proved by two of the firm's earlier models, which are heat-resistant and withstand weld spatter.

Headgears are of smooth, easy-to-clean plastic with cork-padded sweatband. Friction pivots may be adjusted by hand while helmet is in use to hold it in any position or make it float down without jolting stops.

JACKSON PRODUCTS, INC.

* * *

A-c arc welder

68 MANUFACTURER claims this new a-c arc welder is the first to feature use of non-conductive fiberglass in a welding cabinet. This "Perma-Shield" construction is said to solve problems of losses from "eddy currents" and hysteresis. Usable welding current output of the transformer is increased to give maximum welding efficiency.

Four models in welding-current ranges from 25 to 275 amp are available. Each features the "instant arc" for fast, easy arc striking.

MARQUETTE MFG. CO., INC.

For more information use card on page 65.

Tempilstik°

FOR ALL HEAT-DEPENDENT OPERATIONS

looks like a crayon...

marks like a crayon...

tells temperatures like a precision instrument!

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures—plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM ...WRITE WELDING SALES FOR SAMPLE TEMPIL° PELLETS...STATE TEMPERATURES OF INTEREST—PLEASE!

Tempil°
CORPORATION
132 WEST 22ND STREET
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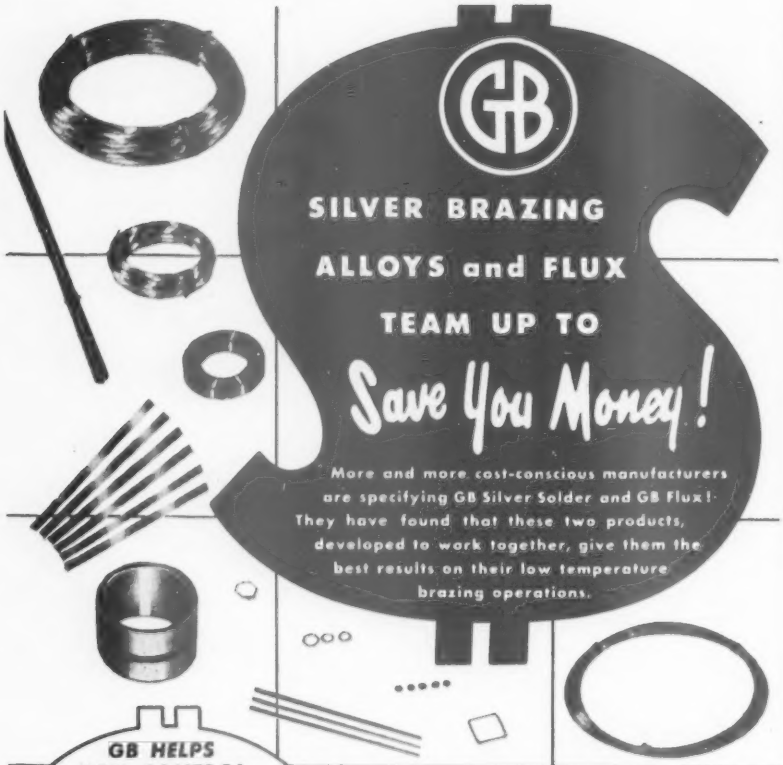
VISIT BOOTH 1523—METAL SHOW


SILVER BRAZING
ALLOYS and FLUX
TEAM UP TO
Save You Money!
More and more cost-conscious manufacturers are specifying GB Silver Solder and GB Flux! They have found that these two products, developed to work together, give them the best results on their low temperature brazing operations.

GB HELPS YOU CONTROL THESE COST FACTORS!

SPEED
HEATING
MATERIAL
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FIT-UP
PREPARATION

GB Silver Solders are available in six standard alloys—each developed to meet specific cost and production requirements. All are available in the most convenient form to meet your needs—wire coils or straight lengths, strips, sheets or formed pieces.

GB No. 50 Silver Solder, melting range 1160-1175°F
GB No. 50N Silver Solder, melting range 1240-1260°F
GB No. 45 Silver Solder, melting range 1125-1145°F
GB No. 41 Silver Solder, melting range 1125-1160°F
GB No. 35 Silver Solder, melting range 1130-1270°F
GB No. 31 Silver Solder, melting range 1130-1300°F

And, if you require a special Silver Solder, Goldsmith's Technical Service Division is ready to give you competent assistance—their recommendations will be backed by 80 years of experience in alloying and refining precious metals.

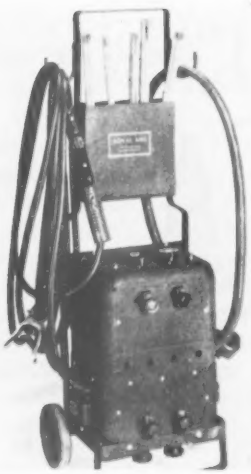
GB FLUXES

Produced under strict laboratory control, GB Fluxes are fully active, deep penetrating, stable and economical. While developed primarily for use with GB Silver Solders, they produce high quality joints with any good silver solder.

GB DATA BOOK

Here's down-to-earth information on the important phases of low temperature brazing. You can get a free copy from your GB Distributor—Write us and a copy will be forwarded to you.

GOLDSMITH BROS. SMELTING AND REFINING CO.
1304 W. 59th Street, Chicago 36, Illinois
Suppliers of Precious Metals to Industry Since 1867



Arc welder

69 DESIGNED for heavy-duty welding, the "Model 400A" welder is guaranteed to weld with a ¼-in. electrode on 220 or 440 volts, 50/60-cycle, single-phase current—either from power company or portable generator. Weighing 140 lb, unit is mounted on its own wheel base and can be easily moved from one job to another.

ROYAL ARC INDUSTRIES, INC.

* * *

Safety clothing

70 LIGHTWEIGHT safety suits are made from "Fyre-Armor" fabric, which has flame-resistant fabrics fused to metallic layers that are topped by specially treated aluminum foil. These aluminum surfaces are said to have reflective powers that reach almost 100% efficiency.

Suits come in 10 models and are equipped with special hoods and masks. The fabric is said to afford protection against temperatures up to 2,500 F.

FAR-EX CORP.

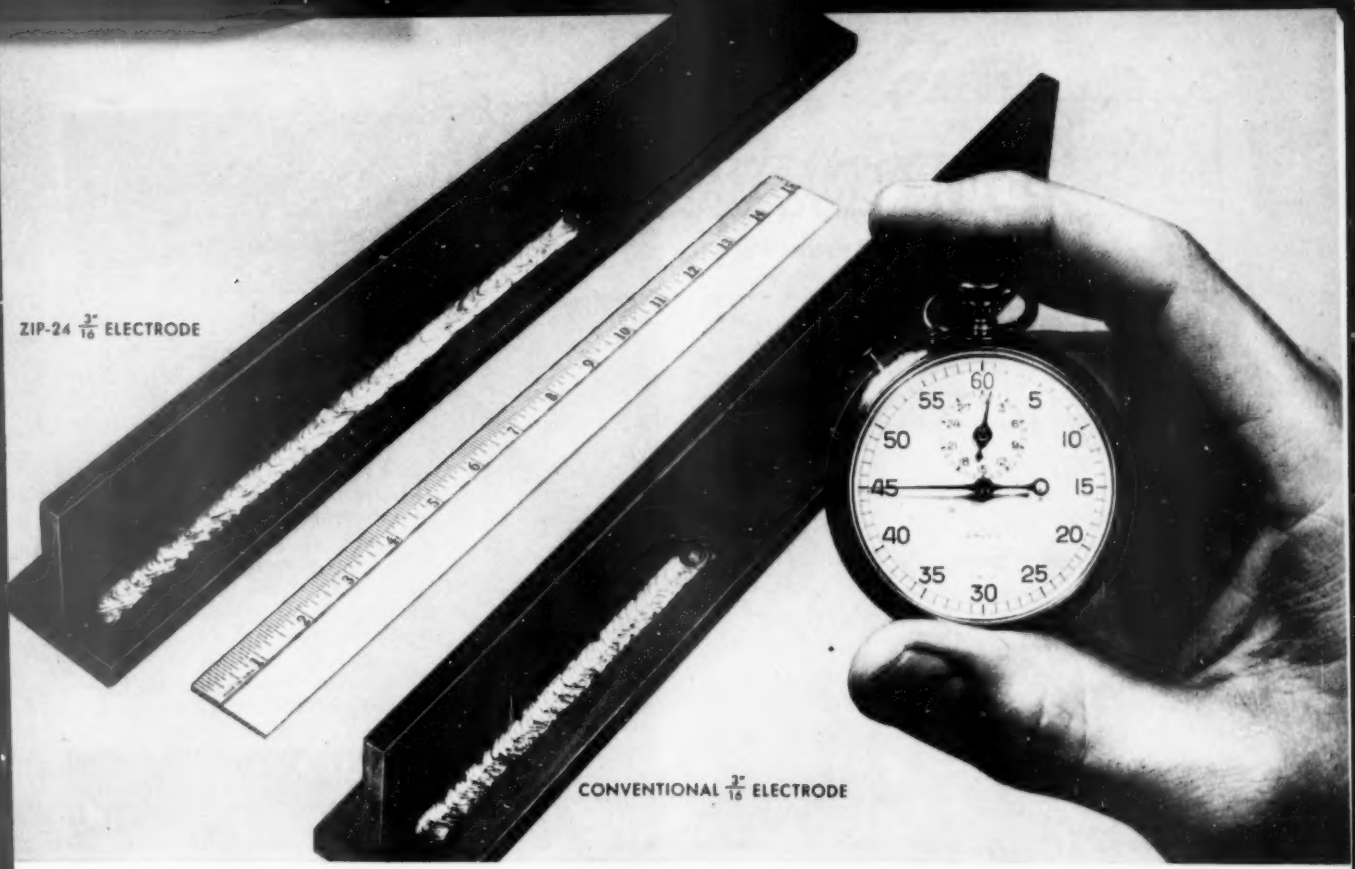
* * *

Electrode

71 PERFECTED iron-powder electrode is virtually self-cleaning, according to manufacturer. Named the "SW-44," the new electrode is said to enable the user to deposit far more E-6012-type weld metal. Bead appearance is smooth with fine ripples, states a further claim. Re-striking is easy, even with an electrode that has completely cooled.

A. O. SMITH CORP.

For more information use card on page 65



New Westinghouse ZIP-24 Electrode welds twice as fast—better, easier, too

The greatest advancement in mild steel welding electrodes in years. That's what Westinghouse research, plus years of experience as an actual user of welding processes, has made the new ZIP-24. It now gives you a greater combination of plus features than any other powdered iron electrode. For example:

FASTER WELDS—*50 to 70%* greater deposit rates. And an increase of *30 to 50%* in footage of fillet or lap weld per minute.

BETTER WELDS—balanced fillets give appearance of "machined finish" . . . no undercut with fillet and lap welds . . . perfect wall wash-up . . . easier slag removal . . . minimum spatter loss that reduces cleaning time. And if that's not enough . . .

EASIER WELDS—even-edged, smooth, finely rippled weld beads even when handled by an inexperienced operator. It's ideal for "drag" technique . . . gives greater flexibility in weld types . . . can be used with either a-c or d-c. And it's available now for . . .

IMMEDIATE DELIVERY—made possible with the opening of our second electrode plant . . . a brand-new Westinghouse Electrode Plant at Montevallo, Alabama. Over 57,000 square feet of additional manufacturing space to give you immediate delivery on the new ZIP-24 and the complete line of quality electrodes . . . *manufactured by Westinghouse.* J-21859

LEARN MORE ABOUT THE NEW ZIP-24 ELECTRODE!

YOU CAN BE SURE...IF IT'S

Westinghouse

WESTINGHOUSE ELECTRIC CORPORATION
Welding Department, P. O. Box 868, Pittsburgh, Pa.

Please send me a copy of your new folder on the ZIP-24 electrode (B-6389).

☐ I would like free samples of the new ZIP-24 electrode.

☐ Send me literature on the complete line of Westinghouse Electrodes (B-6070).

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COMPANY _____

ADDRESS _____

CITY _____ STATE _____

WE-11-54

BERNARD

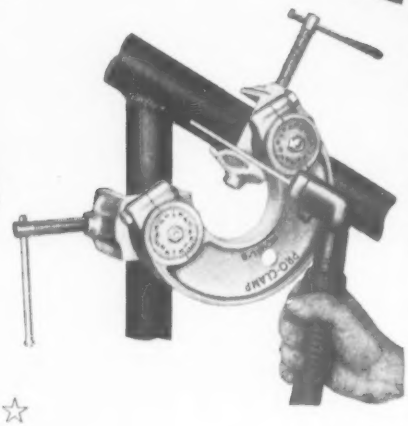
(PIONEER FOR MODERN WELDING)

"Shortstub" ELECTRODE HOLDER

The jaws substitute for stub waste by splicing a 2 inch extension to the length of every electrode.

"Pro-Clamp" MECHANICAL HANDS

MODERNIZE the fabrication of plates, shapes, rods, bars, pipes, etc. MAKE fitting, positioning, holding, and welding a fast, accurate, inexpensive, one-man job.



"Multi-Pic" CONTOUR CLEANER

Delivers FIVE surface cleaning blows with each swing and lasts FIVE times longer than single headed hammers.

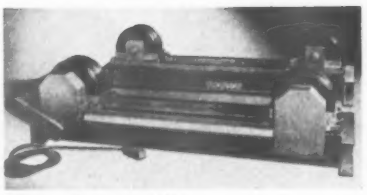
HAS 5 CONTOUR FORMING HEADS WHICH MEANS 5 TIMES FASTER CLEANING ACTION.

See Your Local Dealer, or, Write for Bulletins, SS-3, MP-6 and PCB-6

Manufactured By

BERNARD WELDING EQUIPMENT CO.

10232 AVENUE N, CHICAGO 17, ILLINOIS



Turning roll

72 RUBBER-tired turning rolls, models "WRD" and WRI," have capacities from 5,000 to 100,000 lb per unit. Most common application: in automatic welding of large cylinders. Turning speeds from zero to 80 ipm in the 5,000-lb class and zero to 38 ipm in the 100,000-lb class are provided by compact transmission, which has a micrometer dial control for sensitive control. Safe diameter range is 8 in. minimum to 16 ft maximum.

Manufacturer claims crushing of tires is impossible regardless of load.

ARONSON MACHINE CO.

* * *

Grinder

73 LIGHTWEIGHT vertical grinder is for cup and cut-off wheels, sanding pads and wire brushes. The tool measures 5½ in. to top of spindle washer; overall height is 7 in. Listed speeds are 8,000, 6,000 and 4,500 rpm. Speed is controlled by a quick-acting governor threaded into roto shaft. Grinder weighs 6¾ lb.

THE ROTOR TOOL CO.

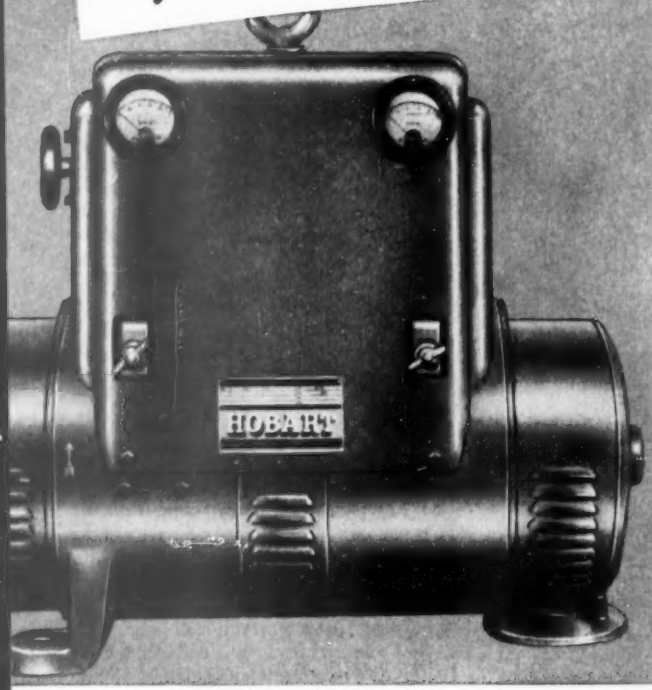
* * *

Spatter-proofing

74 WELD spatter comes off in a fraction of the time and for a fraction of the expense of ordinary methods through use of "Protect-O-Metal No. 2," claims this manufacturer. Just brush or spray the product in the weld seam and on adjacent metal prior to welding. After welding, simply wipe off spatter with a dry cloth. Smooth, clean surfaces are said to be attainable. The compound contains no oils or organic ingredients, will not cause smoke, fumes or odors. One coat serves for single or multipass welds.

G. W. SMITH & SONS, INC.

If you use Automatic Welding - you can't afford to pass up this information!

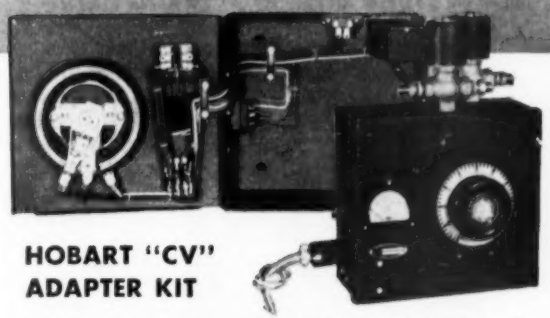


For submerged or open arc here is vastly improved performance . . . NEW CONSTANT VOLTAGE welder with adapter kit brings you faster, better and more profitable welding because voltage at the work remains constant at all times.

HOBART POWROMATIC Welder and Adapter Kits

With a Hobart Powromatic welder and adapter kit you can improve your present continuous wire feed welding operations to the point where you can really call them automatic.

The Hobart Powromatic welder is designed to maintain a constant arc voltage at a preset value. Once the type and size of wire is established and correct arc voltage is determined, the amount of current to the arc is automatically adjusted by Powromatic to suit the speed of the wire feed. In doing this a simple adapter kit does away with the complicated mechanisms you now use.



HOBART "CV" ADAPTER KIT

This kit will make it easy to adapt the indicated type of existing submerged arc Automatic Heads using the three types of wire feed motors.

HOBART BROTHERS COMPANY, Box U-1142, TROY, OHIO, U. S. A.

HOBART TROY OHIO WELDERS

"One of the world's largest Builders of Arc Welders and Arc Welding Equipment"

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or contact your nearest Hobart Distributor for further information. No Obligation!

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Please have your representative call and give us complete details on Powromatic welders and adapter kits. No obligation.

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☐ COMPLETE WELDER CATALOG
☐ ELECTRODE CATALOG.

NAME _____ POSITION _____

FIRM _____

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ANNOUNCING... The most revolutionary achievement in ARC WELDING EQUIPMENT in years...

OBSOLETES ALL OTHER WELDERS OF COMPARABLE RATING!

Dimensions: only 11" x 12" x 7½"

BREN WELD MODEL 200 AW

FIRST TRULY PORTABLE 200 AMP. OUTPUT

ARC WELDER

Patent Pending

Weighs only 65 lbs... Carry it to the job!

Here's the BREN/WELD Portable Arc Welder on a maintenance job in the plant. It's equally "at home" anywhere – including production use.

A sensational transformer development permits the amazing BREN/WELD to do the work of conventional welders up to five times its size and weight! Handles electrodes from 3/64" to 5/32" and operates on 110/220 volts AC 50/60 cycles. Rated at 200 amps, it can actually deliver as high as 250 amps at reduced duty cycle. *Anyone* can make a professional weld with it. Has adjustable arc voltage for different arc characteristics.

Fully guaranteed, the BREN/WELD is rugged and highly efficient for use in almost every industrial plant, including automotive and aircraft–for both production and maintenance. Particularly desirable in construction work, automotive repair, on farms and in home workshops... Incomparable for shipyards and railroad shops.

Once you try this compact, power packed arc welder you'll wonder how you've gotten along without its convenience and wide range. See your dealer or write us direct for details of free trial offer!

LIST PRICE $169.50 F. O. B. LONG ISLAND CITY, N. Y.

24 HOUR DELIVERY FROM STOCK!

KASSON

Manufactured by BRENNEN, BUCCI & WEBER, INC. New York City

SALES DIVISION
KASSON DIE & MOTOR CORPORATION
Integrity Since 1919
32-14 NORTHERN BOULEVARD, LONG ISLAND CITY 1, N. Y.

Soldering gun

75 Low-cost "Junior" soldering gun is claimed to have ample power for all general soldering—instant heat at a power rating in excess of 100 watts. Trigged control switches heat on or off at touch of a finger. Dual prefocused spotlights illuminate work area. Equipped with a standard replaceable "Weller" soldering tip, which is easily interchanged with new accessory tips for smoothing and cutting.

Weller Electric Corp.

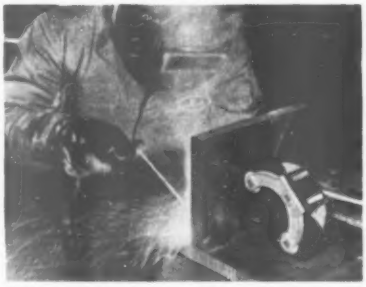
* * *

C clamp

76 Aluminum alloy C clamp is said to be fast acting. Replaceable parts include copper-plated screw with handle, fast-action nut, pressure spring and copper-plate shoe. The clamp is light, durable and resists adherence of weld spatter, according to manufacturer, who further claims it is an excellent conductor of electricity for ground clamps.

Jergens Tool Specialty Co.

* * *

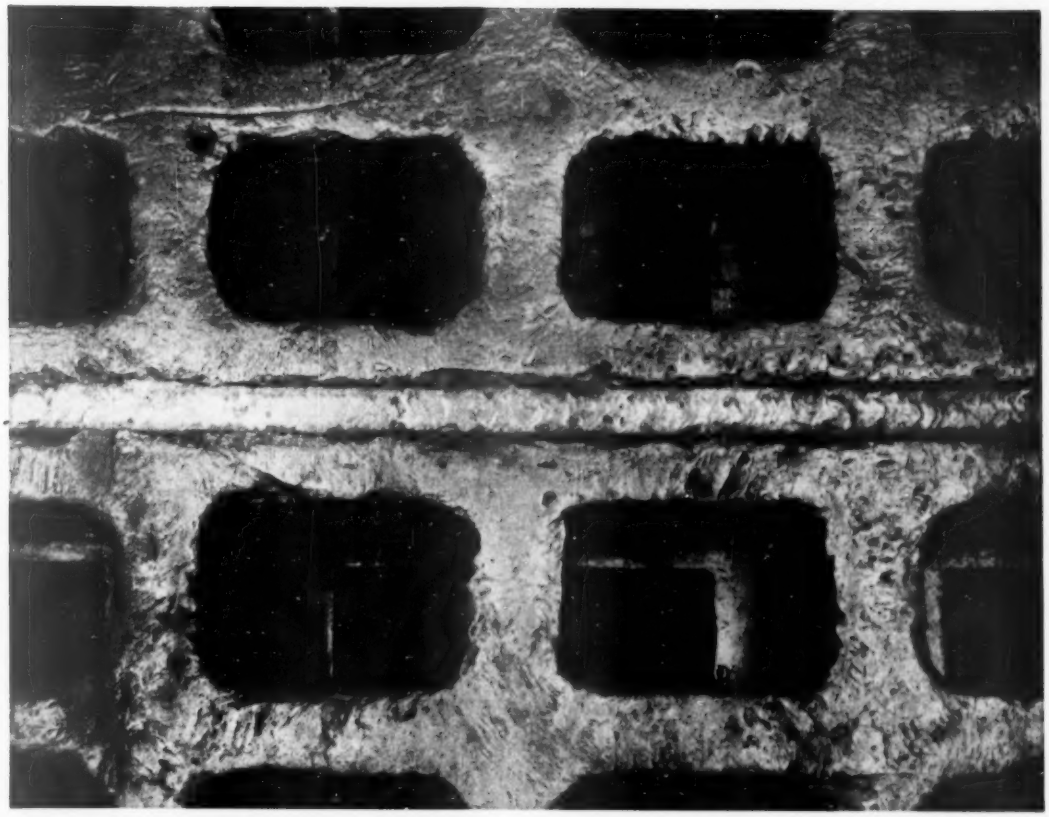


Magnetic positioner

77 "Magic Positioner" is new magnetic holding fixture for welding and production operations. It consists of three 45-lb pull, Neoprene-covered, permanent magnets. Magnets are held in a die-cast, high-tensile aluminum frame and have full 360-deg adjustment.

When positioned, each magnet can be locked in place. The tool is said to hold securely frames, mitered joints, pipe and even rings in firm welding position at angle required.

Standard Portable Cord Co., Inc.



This weld needed no preheat or postheat when made with Ni-Rod "55." A sound weld? Take a close look at this section of it. It joins two 8300 lb. Ductile Iron castings. Each casting, which measured 6 ft. by 10 ft. by 8 in., was annealed before welding. The ten-foot joint needed only 3 passes to complete. After each pass, slag was easily removed by wire brushing. The castings were not stress relieved after welding.

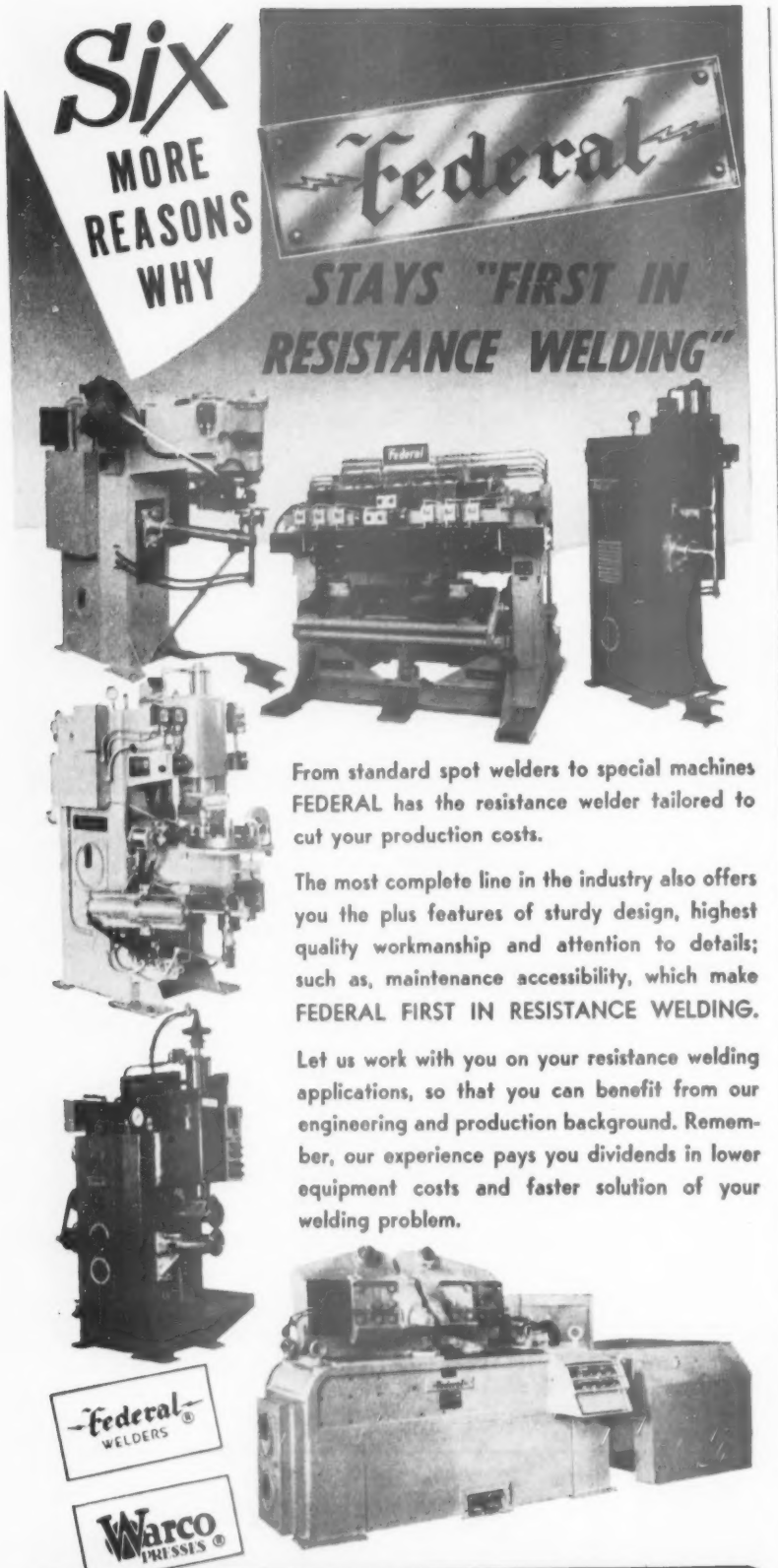
Shake-out grate shows how strongly you can weld Ductile Iron with Ni-Rod "55"

Ten months of rough treatment and this Ductile Iron foundry shake-out has needed no repairs. Made by the Simplicity Engineering Co. of Durand, Michigan, for Beloit Foundry Co. in Beloit, Wisconsin, it is being used to shake out sand from castings as heavy as 55 tons! All welding of the Ductile Iron to itself and to the steel structure was done with Ni-Rod "55®." Despite the terrific battering the deck takes, there's no sign of welds opening up; it's crack-free. Operation of the shake-out has been quieter, too, and peening and spalling have been less than is usual with steel.

The next time you have a job of production or repair welding on Ductile Iron get *sound* welds easily with Ni-Rod "55." (It works on either A.C. or D.C.) Write today for our free folder, *Ni-Rod "55."*

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **Welding Products**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STAYS "FIRST IN
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From standard spot welders to special machines FEDERAL has the resistance welder tailored to cut your production costs.
The most complete line in the industry also offers you the plus features of sturdy design, highest quality workmanship and attention to details; such as, maintenance accessibility, which make FEDERAL FIRST IN RESISTANCE WELDING.
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THE FEDERAL MACHINE & WELDER COMPANY
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NEW PRODUCT BRIEFS

78 **Precision** gas-air mixing and carbureting machine is useful for producing mixtures for flame-hardening, torch brazing, torch annealing and soft metal melting. WAUKEE ENGINEERING CO., INC.

* * *

79 **Compact,** self-contained dust collector for exhausting toxic gases and cleaned air outdoors is rated at 558 cfm on a 4-in. inlet. AGET DETROIT CO.

* * *

80 **Compact,** high-intensity viewer for interpreting industrial X-ray film is claimed to eliminate operator error, speed interpretation and save time by permitting spot scanning and study of any part of a film. MITCHELL RADIATION PRODUCTS CORP.

* * *

81 **Damage** caused by moisture in your gas lines is prevented with this "Little One Eye" moisture indicator, according to manufacturer. PILOTROL CORP.

* * *

82 **Sine** fixture key is said to eliminate five operations heretofore necessary in milling fixture key slots. Stemmed construction of the key requires a bored hole instead of the standard milled fixture key slot. JERGENS TOOL SPECIALTY CO.

* * *

83 **Beam** of light, interrupted by inscribed reticle of a precision "feeler" microscope, measures deviations as small as 0.000025 in. on flat surfaces up to 20 in. long in "Huet Optical Straightedge." F. T. GRISWOLD MFG. CO.

* * *

84 **Granular** alkaline-type aluminum etchant "Composition No. 160," is reported to provide a rapid, uniform controlled etch on aluminum and eliminate problem of hard sludge build-up on equipment surfaces. OAKITE PRODUCTS, INC.

* * *

85 **Booster**-battery and fast charger clip, called "Hippo-Clip," has lead-plated steel handles and a lead-coated spring to resist corrosion. Jaw spread is 1 9/16 in. MUELLER ELECTRIC CO.

For more information use card on page 65

7,980 PHOSON BRAZED JOINTS

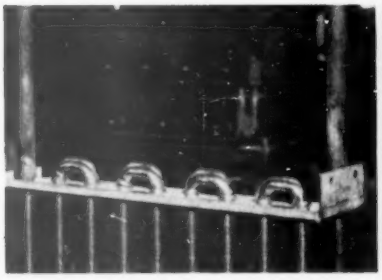
3 REJECTS

Reports **BUSH** *on Refrigeration Coil*

Bush Manufacturing Company, Hartford, Connecticut brazes 24 alloy rings on copper U bends in a continuous chain belt operation through fixed torches. The brazing process is automatic.

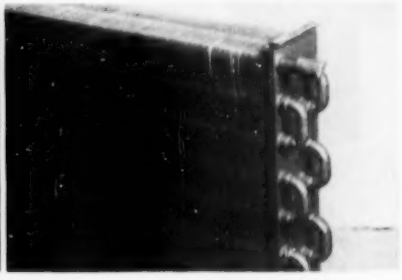
Testing each assembly under 300 pounds of air pressure, Bush reports only *three rejects* in 7,980 joints.

Bush also produces 8 times as many units the STRONG, LOW TEMPERATURE, PHOSON WAY, than with the old torch and rod method.



1. Refrigeration coil U bends shown with PHOSON brazing rings in position ready for production brazing.

2. View of straight line PHOSON brazing operation showing fixed torches and continuous belt action.



3. This is the finished PHOSON brazed refrigeration coil. No further machining or polishing needed . . . a clean, smooth job every time.

GET DEPENDABLE, LOW COST PHOSON IN STRAIGHT LENGTHS, COILS OR PREFORMED RINGS.

NEW PHOSON PERFORMANCE TELLS THE STORY!

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ASK FOR NEW PHOSON BOOKLET

See New Color, Sound Movie
"WHEN METALS ARE BRAZED"
Write United Wire for showing date in your city!

UNITED WIRE
AND SUPPLY CORP.
Brazing Alloy Division
PROVIDENCE 7, R. I.
OFFICES IN PRINCIPAL CITIES

Amazingly simple EASY-FLO or SIL-FOS brazing pays big dividends

EASY DOES IT—An endless chain runs at predetermined speed between a pair of city gas-air burners. Operator places bodies in angle-iron carriers, takes spuds with preplaced EASY-FLO rings, dips them in Handy Flux and sets them in bodies. The rest is automatic. Using only one row of carriers, output is 18 a minute.

Expert "Know-how" at your service

In cooperation with the manufacturer we worked out the valve brazing set-up – and we're ready to work with you. As originators of EASY-FLO and SIL-FOS low-temperature silver brazing alloys, we offer you the benefit of the maximum technical knowledge about the process and practical experience in its application available anywhere today. There's no obligation for this assistance. Just phone or write when you would like a field service engineer to call.

It's a safe bet you can get a better product at much lower cost on several of your metal parts by designing them for EASY-FLO or SIL-FOS silver brazed construction – supplemented by a simple production set-up that makes the brazing so easy – *anybody can do it!*

Here's an example – a radiator valve. It is made of a simple drawn body and a screw machine part, brazed with EASY-FLO. And the joining is done on a set-up that "automation-izes" the actual brazing. The net results – a smaller, trimmer valve – and a favorably low production cost.

FOR THE FACTS IN PRINT...
Write for Bulletin 20. It gives them all plus a lot of useful information about fast, low-cost production brazing.

At the METAL SHOW—Chicago—Nov. 1-5
SEE the comprehensive exhibit of low-temperature silver brazing jobs from many industries. Our engineers with the know-how will be there ready and waiting to chat with you about your metal joining. BOOTH 342

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NEWS . . . . . *from page 6*

facturer's responsibility was discussed by J. E. Norcross, sales manager of Arcos Corp., Philadelphia, while such training as a distributor's responsibility was covered by Roy H. Silver, of Silver Welding Supply, Inc., Roslindale, Mass. The other panel discussion—on steps used to reduce the number of slow-paying accounts—was handled by Howard Montaigne, of District Oxygen Co., Inc., Brentwood, Md.; J. W. Albiston, Maine Oxy-Acetylene Supply Co., Auburn, Me.; Charles Cane, Welders Supply Co., Toronto, Canada; and Frank P. Marcus, Eastern Welding Equipment Co., Long Island City, N. Y.

NWSA President James N. Alcock, Saginaw Welding Supply Co., Saginaw, Mich., headed the list of speakers at Boston as he did at the Hotel Cleveland, Cleveland, where the Central Zone met Sept. 16 and 17. A record attendance of 150 delegates was achieved at the Cleveland meeting.

Conducted by NWSA Vice-President E. C. Caluwaert, of O.K.I. Welding Supply Co., Cincinnati, the Central Zone session also included a panel discussion on problems that confront distributors today, including slow-paying accounts. The second panel discussed sales training. The manufacturer's role was discussed by N. L. Andrus, Smith Welding Equipment Corp., Minneapolis, the distributor's by R. P. Tarbell, Scott-Tarbell, Inc., Cleveland.

A tour was made of The Lincoln Electric Co.'s plant.

New applications for membership during the Central meeting were received from Industrial Supply & Equipment Co., Akron; Superior Oxy-Acetylene Machine Co., Hamilton, O.; Welker Welding Supplies, Cleveland; Woodward Welding Supply Co., Inc., Detroit; and National Cylinder Gas Co., Chicago.

During the Eastern zone meeting in Boston, Interstate Welding Supply Corp., Cambridge, Mass., applied for membership.

* * *

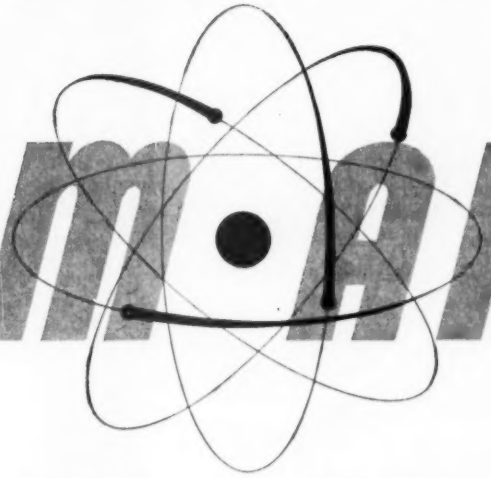
Inco expands cold-draw section at Huntington

A NEW cold-draw section, which extends length limitations on rods and tubes and triples capacity for producing heat-exchanger tubes, is now in operation at the Huntington (W. Va.) Works of The International Nickel Co., Inc., New York City.

The unit comprises a building extension 350 ft long by 108 ft wide, a draw bench capable of drawing some tubes and rods up to 85 ft, and a gas-fired furnace 220 ft in overall length.

An Entirely New Concept of Low Hydrogen Welding

ATOM•ARC



Combining the best in welding arc characteristics with the highest physical properties known to steel producers today . . . *ATOM* ● *ARC* electrodes meet the stern requirements of the Atomic Age.

Compare Atom • Arc with Ordinary Low Hydrogen Electrodes

Faster . . . For the first time in the industry, *ATOM* ● *ARC* utilizes iron powder in the electrode coating of a low hydrogen electrode—making possible the use of higher welding currents with either A.C. or D.C.

Greater Deposition Efficiency . . . Amazing deposition efficiencies are made possible because iron powder contained in the electrode coating serves as an additional source of weld metal.

No Moisture Pick Up . . . *ATOM* ● *ARC* is packed in 50-lb. hermetically sealed metal containers. Electrodes will effectively resist detrimental moisture pick up for ten days after opening container.

Weld Appearance . . . The full covering, easy to remove slag helps to form a smooth, uniform weld bead—free of undercut.

Ease of Welding . . . *ATOM* ● *ARC* reduces welder fatigue because the heavy electrode coating permits contact with the work in all positions.

Highest Physical Properties . . . *ATOM* ● *ARC* is manufactured in six A.W.S. low hydrogen grades and will meet all specifications for these types of electrodes.

At the *METAL SHOW* . . . See ATOM • ARC demonstrated at the Alloy Rods Company Booth #1359 at the Metal Congress, Chicago, November 1 to 6. Call your Alloy Rods Company distributor or write to nearest plant for further information.

ALLOY RODS COMPANY

NO FINER ELECTRODES MADE . . . ANYWHERE

General Offices & Plant
YORK 2 • PENNSYLVANIA

Pacific Coast Division
EL SEGUNDO • CALIFORNIA

Alloy Rods Co.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

GENERAL OFFICES: 60 EAST 42ND STREET, NEW YORK 17, N. Y.

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

Ranite HARD SURFACING RODS

... are designed to produce highly wear resistant overlays ranging in hardness from 30 Rockwell "C" to 66 Rockwell "C"

SOLD THROUGH YOUR LOCAL DISTRIBUTOR

RANKIN MANUFACTURING CO.

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Utah site of new electric weld pipe mill

ELECTRIC weld pipe will be produced at a new plant to be constructed by Consolidated Western Steel Division of U. S. Steel Corp. It will be located near the Geneva Works of U. S. Steel's Columbia-Geneva Steel Division near Provo, Utah.

Pipe used in transmitting natural gas, petroleum products and water will be made in the new Utah mill, which is expected to have about 200 employees when production begins next spring. About 175,000 sq ft of the 117-acre site will encompass the main building which will house equipment for manufacture of large-diameter expanded pipe in sizes from 20 to 36 in. and facilities for producing small-diameter, resistance-welded line and water pipe in sizes from 4 to 12¾ in.

Other principal structures will be an office building and a building to house equipment for coating and wrapping small-diameter pipe.

The new plant will replace line pipe manufacturing facilities of Consolidated plants at South San Francisco, Los Angeles and Berkeley, Calif. The firm's Orange, Texas, pipe mill will be unaffected by the centralization of far western line pipe operations in one location.

* * *

Marcus transfers its manufacturing operations

MARCUS Transformer Co. recently transferred its manufacturing operations to an enlarged plant in Rahway, N. J. The move consolidates under one roof the operation of two former plants in Hillside, N. J.

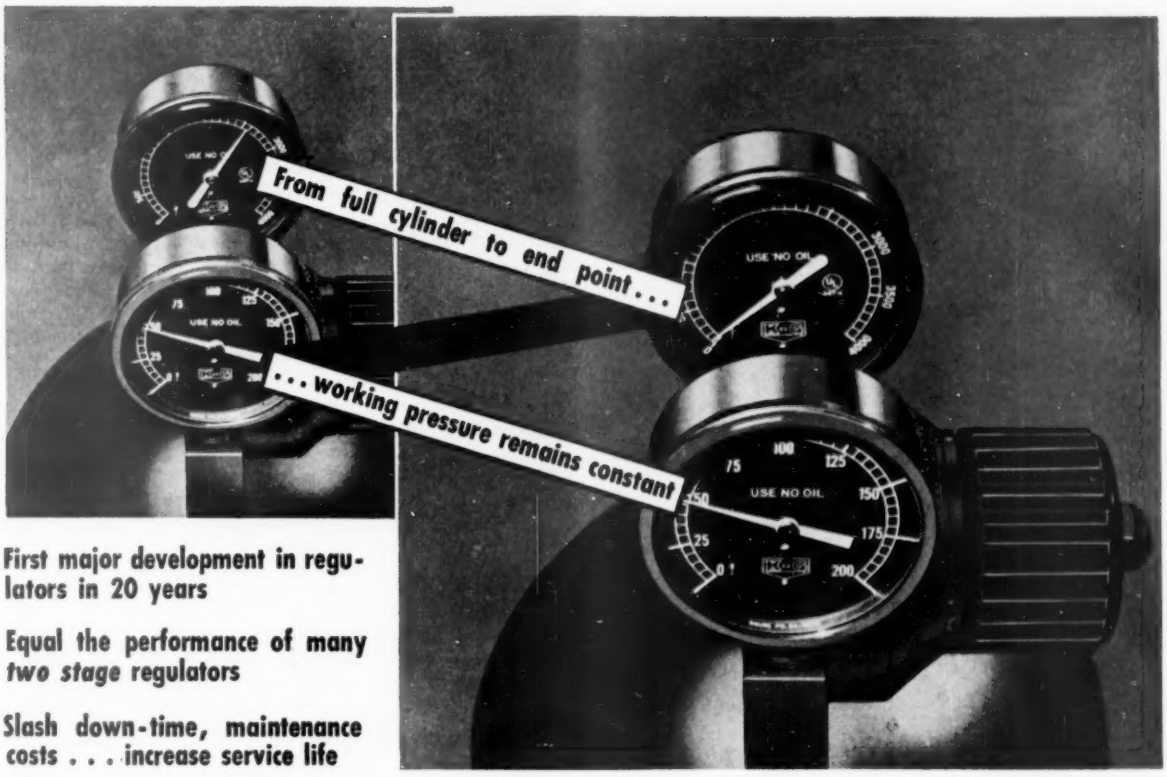
* * *

Plastics firm formed by Tube Turns

ESTABLISHED jointly by Tube Turns Division of National Cylinder Gas Co. and Jackson & Church Co., Tube Turns Plastics, Inc., will manufacture industrial plastic pipe fittings and custom molded products. Located in Louisville, the firm will make exclusive use of a new patented process of injection molding of unplasticized polyvinyl chloride.

David L. Perrot, chairman of the board and exceutive committee of Jackson & Church, was elected board chairman of the new company. George O. Boomer, chairman of the executive committee of NCG, was elected president. Carl McLaughlin, formerly assistant to the executive vice-president of Tube Turns, was elected executive vice-president.

New K·G Single Stage Regulators Out-perform All Others



First major development in regulators in 20 years

Equal the performance of many *two stage* regulators

Slash down-time, maintenance costs . . . increase service life

Get jobs done better, faster . . . virtually eliminate pressure readjustment. The new K-G Single Stage Regulators equal the performance of many two stage regulators—yet cost no more than many standard single stage models.

This superior performance—plus longer life and faster, easier maintenance—are the result of an entirely new, simplified design:

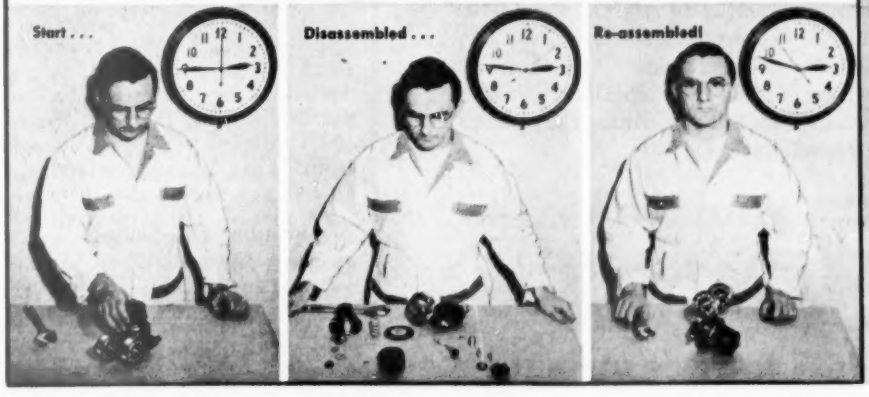
Bodies and bonnets are anodized aluminum alloy forgings . . . are stronger, lighter, more resistant to corrosion. The large-size diaphragm greatly increases sensitivity . . . a new stainless steel sintered metal filter practically eliminates seat failure . . . the adjusting mechanism rides on ball bearings for smooth, accurate control—is *fully enclosed* for complete protection against damage or loss.

The new single stage models—1200 Series—are available for practically all compressed gases, as are the new companion-product two stage models—1100 Series (for the ultimate in performance!). *The K-G Equipment Co., Inc., Dept. A., 1744 Lehigh St., Allentown, Pa.*

Ask Your K-G Distributor for a Demonstration—Send for New 24-page K-G Catalog

(Distributors: Valuable territories still open. Write for information!)

Take Apart, Re-assemble in 3 Minutes!



AMAZING FILTER ACTION

Is shown by this sand test. Ask your K-G Distributor to demonstrate!

ARCOS FOR FINEST QUALITY WELDS

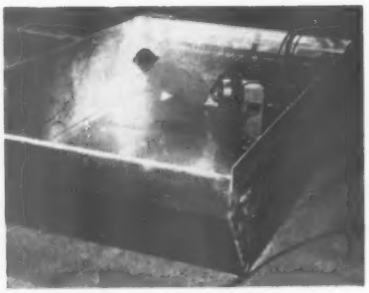
New Arcosite flux now makes possible submerged arc welding of stainless

Now you can enjoy full economy from submerged arc welding of stainless steel. New ARCOSITE FLUX and ARCOS CHROMAR (Stainless Steel) WIRE make this possible for the first time.

One reason for this is the skillful formulation and manufacture of ARCOSITE FLUX. Carefully controlled particle size of the flux assures you uniformity of arc action, alloy recovery, bead penetration and shape, and easy flow through flux feeding devices. Combined with the controlled analysis of ARCOS CHROMAR WIRE you get the advantages you need for successful welding: Mechanically sound, corrosion resistant welds . . . freedom from cracking . . . positive transfer of essential stainless elements. Write today for new Arcosite Flux Bulletin. Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Pa.

WELD WITH ARCOS

STAINLESS WIRE AND ARCOSITE FLUX



Welded aluminum barges being used in Texas

FIRST welded aluminum barges built in this country are being used at the Rockdale, Texas, works of Aluminum Co. of America. They were built by Butler Mfg. Co., Birmingham, Ala., entirely from lightweight, corrosion-resistant aluminum. They measure 13½ ft long, 7½ ft wide and 2½ ft deep.

Welding was by the Mig (metal inert-gas) method, and welding speed was about 24 ipm. The barges are being used to support pumps which remove water from cuts where fuel has been extracted for Alcoa's smelting operations.

* * *

35 persons attend welding distributor's open house

THIRTY-five members and guests of National Welding Supply Association from Southern California recently attended an open house at Ted Cox's Welding Supplies, San Bernardino. Ted Cox served as host and master of ceremonies for a program that included an inspection of his new store and a talk by R. C. Riegel, superintendent of electric pipe mill, Kaiser Steel Co., Fontana, Calif.

Mr. Riegel discussed the manufacture of pipe and showed a motion picture of the operation.

* * *

Western metal show scheduled for March

NUMEROUS welding demonstrations will be included in the program for the ninth Western Metal Exposition, which will be held March 28 through April 1 in the Pan-Pacific Auditorium, Los Angeles. The ninth Western Metal Congress will be held concurrently at the Ambassador Hotel.

* * *

Magnesium Association to meet Nov. 15-17

TENTH annual meeting of the Magnesium Association will be conducted Nov. 15 through 17 at the Hotel Chase, St. Louis.

Swiss welders to equip Indian box-car works

VARIOUS types of arc and resistance welding apparatus to be used in fabrication of railroad (mainly box) cars by the Indian Railroad Ministry are being supplied by Brown Boveri and Co., Baden, Switzerland.

The Indian government is building near Madras a large plant which will begin operation in mid-1955. It will produce about 300 railroad cars per year at full capacity.

All the welding machines are being built to withstand the difficult climatic conditions of Madras—extreme heat and humidity, as well as an atmosphere laden with salt.

—McGraw-Hill World News

* * *

Soviet ships cut up to speed overhaul

A PUBLICATION of the Soviet sea-shipping industry, *Vodny Transport*, claimed in a recent article that the Limenda shipyards are the first anywhere to develop an entirely different method in general ship overhauling. By "sectionalizing" a ship, its idling time is reduced to short periods.

After every detail is checked (during regular service runs) to determine necessary repairs, the ship is docked, then cut into two- and three-dimensional sections. According to the volume of repair, these sections are hoisted to machine shops on shore, where specialists cut out the parts to make repairs. Cutting is done by gas torches.

—McGraw-Hill World News

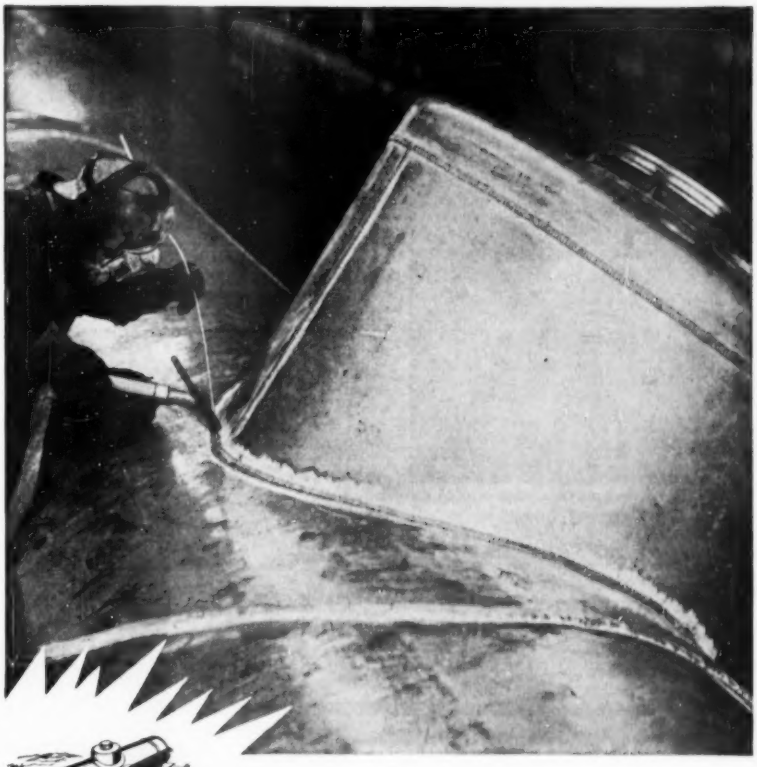
* * *

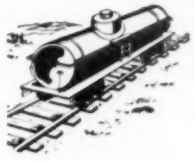
Torch removes welds

—Courtesy Arcair Co.

WELDOR uses a carbon-arc, compressed-air gouging torch to remove welds from ¾-in. mild-steel plate on inside of all-welded steel vacuum tower at Sohio Petroleum Co.'s Latonia refinery in Covington, Ky. Tower, 9 ft in diameter and 92 ft high, is said to be first all-welded tower in U. S., having been built in 1930 with bare welding rod. Original welds were found to be porous, so they were burned out and replaced.

ARCOS FOR FINEST QUALITY WELDS





Putting profitable benefits into welded ***aluminum*** *tank cars*

Besides permitting bigger pay loads with less "dead" weight, aluminum performs a dual role on this *welded* tank car. Inside, it provides even distribution of heat from heater coils to keep viscous fluids free-flowing for fast unloading. Outside it eliminates maintenance—never rusts, never needs painting.

An important key to success on *any* aluminum welding job is the quality of weld metal. Newly-developed ARCOS ALUMINUM RODS and ELECTRODES assure you a dependable answer to this requirement. They give you the properties you need to make the most from aluminum's durability, strength, appearance and maintenance-free qualities. Specify Arcos for profitable aluminum welding. Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Pa.

WELD WITH ARCOS

ALUMINUM RODS AND ELECTRODES

FOR QUALITY WELDMENTS
use
Drawalloy
CORPORATION
QUALITY CONTROLLED
STAINLESS STEEL
WELDING WIRE

▶ available in Spools, Coils and Lengths

▶ for Automatic and Semi-Automatic gas and inert arc welding

Welding wire by Drawalloy is made to an exacting high standard . . . a high standard established by long-experienced welding men who know welding wire and how it must work. Set-ups for automatic and semi-automatic welding take more time than regular welding. That's why you want to be sure of satisfaction *before* you start. This *reliable* wire is weld-tested to give the best results every time. Write today for complete information and prices.

WELDING SUPPLY DISTRIBUTORS: Get prompt delivery on all sizes and grades of stainless and tool steel wire for gas and inert arc welding.

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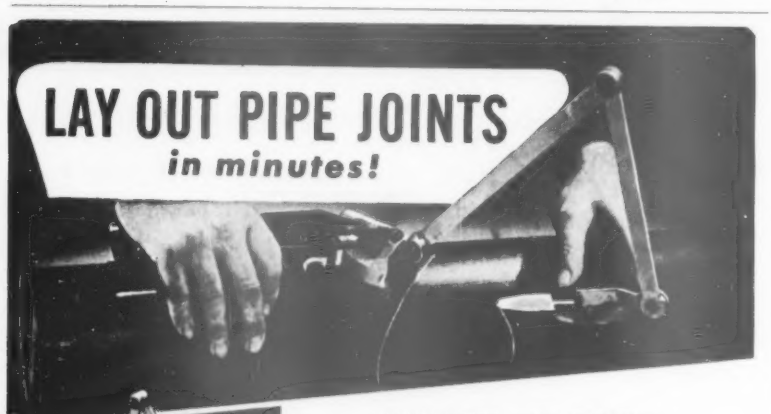
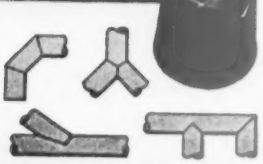
LAY OUT PIPE JOINTS
in minutes!





SAVE TIME AND MONEY!

A SMOOTH SWING of the Contour Marker's soapstone point and you're ready to cut! It's easy and *absolutely accurate* because there is an angle dial calibrated in both degrees and pitch. Any of the pipe joint angles shown can be marked off in minutes. And you save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are completely eliminated. Two sizes are available complete with adapter for marking structural steel. Standard, for pipes from 1½" to 18" dia.; Jumbo, for pipes from 16" to 48" dia. Instruction book included. Belt case available. Write for information

CONTOUR MARKER CORPORATION OF CALIFORNIA
1843 E. Compton Blvd., Compton, California • NEwmark 1-9474

THE CONTOUR MARKER

Excerpts from report on welding titanium

UNDER a prime contract with the U. S. Air Force, Ryan Aeronautical Co., San Diego, has just completed a comprehensive study of titanium. The results of this investigation will be made available to the aircraft industry. Conducted by Ryan's Engineering Division, the study was restricted to sheet-metal manufacturing techniques and commercially pure titanium. Every process involved in sheet metal fabrication, including welding, was analyzed.

Here are excerpts from the report:

Experience in the study showed that inert-gas-shielded welding is the only type of fusion welding that can be made on titanium if it is desired to maintain adequate physical properties. (Molten titanium will react with, and be embrittled by, all known welding fluxes as well as air.) Ryan welded a substantial number of specimens with both manual and automatic inert-gas-shielded methods. Butt welds were successfully made in an automatic machine using $\frac{1}{8}$-in. diameter thoriated-tungsten electrodes and a 5/32-in. electrode distance. A copper tube with $\frac{3}{8}$-in. flare outlet was used to follow up the weld and blanket the hot metal with argon to prevent contamination during cooling. On the underside of the weld a grooved back-up bar was used, which blanketed the underside with argon gas. This arrangement consumed 7 cu ft of argon gas per hour for back-up needs and 20 cu ft per hour at the electrode.

Welds were made at the speed of 27 ipm with 65 amp of current. Results of this work disclosed a number of factors important to good fusion welding of titanium. Many of these are not peculiar to titanium but are also encountered in the welding of stainless steels and other alloys.

Shear cuts must be straight and smooth and fit must be close, running to within 0.001 in. on 0.016 in. material. Poor fit will cause burn-through on light gages. Best back-up is a flat copper bar. On light gages, no gas back-up is necessary if the material is tightly pressed against the copper back-up bar.

In heavy gages, an excessive gap will give a concave bead surface. A slow welding speed will cause a wide bead. Amperage has less effect upon penetration than welding speed. As gages run higher, amperage input goes up, disproportionately.

Welds of good quality, in which the welds were found to be stronger than the parent metal, were obtained. This was revealed in tensile tests in which fractures occurred outside the weld zone. The major yield was confined to

one side of the weld. Failures that occurred in the weld zone initiated in small flaws within the bed. Bend tests indicated that the gas shielding provided good protection and that most welds exhibited good ductility. The welds took a 180-deg bend in both longitudinal and transverse directions without failing.

Ryan performed Mig welding using 0.125-in. sheet and 0.64-in. titanium wire. Circular passes were made on one side of each sheet. The welds were found to be very sound in structure with penetrations of between 20 and 40%. A 180-deg bend was obtained when the bend placed the bead in compression. A bend, placing the bend in tension, fractured at 45 deg. This fracture started at surface of the bead. Microscopic examination of original cracks showed them to be approximately 0.007 in. deep. This indicates that the weld bead may have a contaminated surface skin, which is very hard. Such a surface would shatter under tension and create stress concentrations which would lead to failure. All discoloration of the welding was removed by processing in a salt bath at 800 F for 10 minutes, followed by 20 minutes immersion in a pickling solution.

Following successful butt welding of titanium by automatic Tig welding, a number of lap welds were made. Welds were accomplished in 0.016-in., 0.063-in. and 0.080-in. materials. They were made with manual Tig torches equipped with a follow-up tube of argon-gas flow. Hand-fed, commercially pure titanium wire was added as a filler rod.

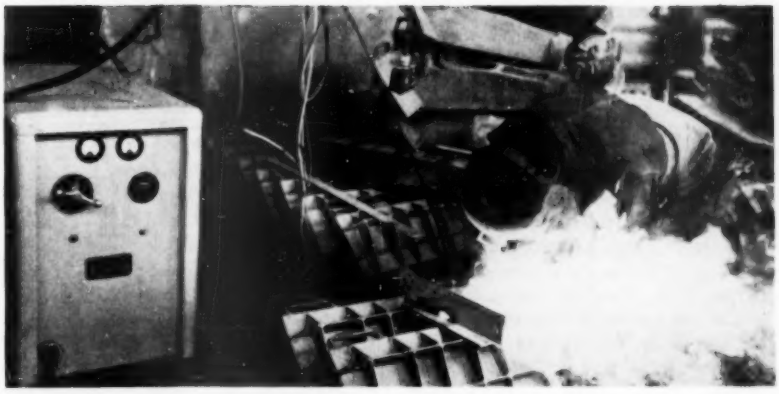
Static tensile test failures occurred either in the parent metal or the weld heat-affected zone. The welds were sectioned and examined for penetration and structure. Results showed that good care is required to maintain proper root penetration.

An additional departure from the handling of stainless steel alloys was noted. When shearing stainless steels in preparation for rolling and welding a cylindrical body, allowances are made for anticipated shrinkage in the longitudinal butt weld. The welded parts are then sized on expanding mandrels. With titanium, no shrinkage in the welded cylinder occurs and it is often necessary to shrink the welded part to mate it with others.

* * *

Plant maintenance show next January in Chicago

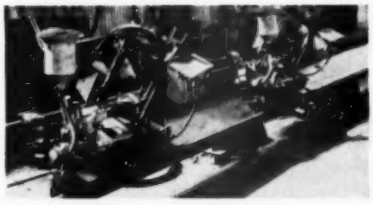
NEXT Plant Maintenance & Engineering Show will be held in Chicago's International Amphitheatre from Jan. 24 to 27. It will be the sixth such event.



SIGMA welding on aluminum with 500 amp. GLENN CV Welder. Constant voltage simplifies, improves MIG welding of all types — ideal for new SIGMA tack and spot weld techniques.

Constant Voltage Power Source Takes Variables Out of Automatic Welding

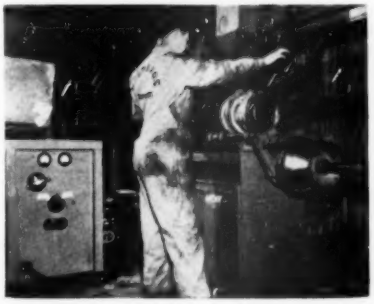
The headaches of automatic welding with old-style power sources – variable voltage, variable feed, variable results – can be eliminated with GLENN Constant Voltage Welders. They deliver a fixed d.c. pre-set arc voltage permitting fixed feed rate and uniform deposit – even when tack-welds or poor fit-ups are encountered.



SUBMERGED ARC—GLENN-powered dual heads make 60' fillet weld; "erase" tacks, leave perfect full-length bead.

SEMI-AUTOMATIC—GLENN CV Welder instant arc start and recovery makes it simple, easy!

HARD FACING with GLENN CV power means smoother, more uniform deposits.



OTHER BENEFITS

Modernizing with GLENN CV Welders provides simplicity of control and operation, uniform high-quality welds with fewer rejects. Faster production schedules and far lower welding costs result. Efficiency is 85% or better, power factor 90% or better at all outputs – you can double the welding capacity of your present motor-generator or transformer supply without re-wiring!

JOB PROVED

GLENN CV Welders are the original – and only – constant voltage power sources job-proved for more than a year on submerged arc, inert gas, "squirt," automatic stud welding, Arcair cutting and gouging. They've licked tough control problems on 3 o'clock and field welding jobs, on pipe mills, roundabout and long seam welds. They've simplified welding on aluminum, copper, stainless, mild and alloy steels.

REMOTE VOLTAGE ADJUSTMENT

Three new models with continuous-duty (100% duty cycle) ratings of 500, 750 and 1200 amperes, 18-42 volt arc voltages, now available. Vernier voltage adjustment, controlled remotely or at machine, standard on all models. Operate from 3-phase a. c. in all common line voltages.

3 *Get the facts now. Write*

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3134 East 10th Street, Oakland 1, California

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If the Welding Job is MANGANESE STEEL

Whenever a job involves manganese steel, you'll get finest results from products made by Taylor-Wharton—oldest producers of this alloy and developers of TIMANG, the original manganese-nickel welding rod.

TIMANG assures easy, uniform, economical welding. It equals the parent manganese steel in hardness, ductility, strength and work-hardening properties. Air-toughening, needs no quenching. Available in 1/8", 5/32" and 3/4" dia., and lengths of 14" and 18", bare and coated.

See your welding supplier.

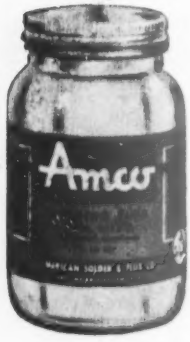
--the best Welding Rod is TIMANG®

Also Manganese Steel Welding Repair Shapes: Rounds, Squares, Flats, Plates, Grouser Bars, Repointers and Repoint Bars
Send for Bulletin #451

TAYLOR-WHARTON IRON & STEEL CO.
HIGH BRIDGE 8, NEW JERSEY
Cincinnati, O. Birmingham, Ala. Easton, Pa.

good welding STARTS with the RIGHT flux

Get stronger welds faster on Aluminum, Stainless and all non-corrosive steels . . . at lower cost, with these AMCO Fluxes.



It's easy to get good welds on every job. Simply select the proper AMCO Flux. Here are two specialized production speeding fluxes.

FOR ALUMINUM: AMCO 4013 effectively dissolves oxides . . . assures thorough, rapid melting and spreading of rod. Prevents reoxidation.

FOR STAINLESS: AMCO 433 completely removes oxides and surface film quickly. Provides a smooth, firm bond. Eliminates reoxidation of rod and base metal at welding temperature.

Welds produced are strong . . . clean. Costs are cut. Get the full story of the many advantages of these fluxes.

• *Tell us your welding problem. We'll recommend the flux. No obligation. Write:*

AMERICAN SOLDER and FLUX CO.

19th & WILLARD STS. • Dept. W., PHILADELPHIA 40, PA.

Welding gun described by Soviet magazine

A SOVIET magazine, *Knowledge Is Power*, describes a new arc-atomic welding gun that weighs about 14 oz and is a little more than 10 in. long. The instrument is hooked to a pipeline containing a nitrogen-peroxide mixture and to any electric outlet.

The pistol-shaped tool is designed to replace the heavy and bulky arc-welding head (described in the article as "arc-atomic welding") with dual jet outlets. The new gun is said to cut consumption of the nitrogen-peroxide mixture in half. A trigger inside the instrument closes the electric current flow to the two electrodes at the gun's nozzle, where the vaporizing nitrogen-peroxide gases create a bluish flame and sufficient heat to melt metals.

During welding, the gun is held at an angle between 30 and 90 deg, and the welding wire is brought to position by the weldor's other hand.

—*McGraw-Hill World News*

* * *

"Microspooled" Mig wire made by Weldrod Co.

START of operations specializing in manufacture of "Microspooled" wire for use in Mig (metal inert-gas) welding processes was recently announced by Weldrod Co., Inc., Meadowbrook, Pa. (in the Philadelphia area). The newly established firm also makes arc-welding electrodes and cutting rods.

* * *

Cast-iron "igloo"

STEEL struts are welded in 40-ton cast-iron upper exhaust hood at General Electric Co.'s turbine factory in Schenectady, N. Y. Struts are welded between steel stubs cast into the iron. Resembling giant igloo, hood is part of the first of six 200,000-kw steam turbine generators being built for Ohio Valley Electric Corp.'s new Clifty Creek plant near Madison, Ind.

Metals clinic in Dallas to be held Nov. 17-18

DEMONSTRATIONS in welding, silver brazing and finishing will be some of the features of an Industrial Metals Exhibition and Clinic to be held from 1 p.m. to 8 p.m. Nov. 17 and 18 in the Dallas warehouse of Metal Goods Corp.

The exhibition is designed to bring the latest technical developments to the attention of metal users. Among companies to participate will be Aluminum Co. of America, American Brass Co., Handy & Harman, The International Nickel Co., Inc., Tube Turns.

* * *

Cooper Alloy Foundry simplifies name

THE Cooper Alloy Foundry Co., Hillside, N. J., recently changed its name to Cooper Alloy Corp. in view of continued extension of facilities and services. President Harry A. Cooper explained that the firm, one of the nation's oldest and largest producers of stainless-steel cast products, has for many years been manufacturing special product lines in addition to producing custom castings.

The company comprises the following four divisions: Foundry Products, Valve & Fitting, Aircraft Products and Stainless Engineering & Machine Works.

* * *

G-E welding plant officially opened

OFFICIAL opening of General Electric Co.'s welding plant at York, Pa., was to have been held Oct. 21. The plant is headquarters of G-E welding products and contains manufacturing facilities that are said to make it one of the more modern organizations of its kind. Formerly located in Fitchburg, Mass., the welding department moved to York last January.

* * *

Distributor appointments

Alloy Rods Co., York, Pa.; District Oxygen Co., Inc., Brentwood, Md.; Dow Supply Co., Grand Forks, N. D.; Edmac, Inc., Winston-Salem, N. C.; J. B. Thomas Co., Nashville, Tenn.; Welding Equipment Co., Oklahoma City, Okla.

Carboloy Dept., General Electric Co., Detroit: Dietz Industrial Supply Co., Aurora, Ill.

Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif.: Erin Metals Corp., Detroit.

Tube Turns, Louisville, Ky.: Pacific Metal Co., Portland, Ore.

It's a cuttin' fool!

Light heavy-weight cutting torch It's a TRIPLE THREAT

Look what this NEW Smith's Cutting Torch gives you:

It is brand NEW. It ingeniously combines more operating advantages than any you have ever seen. Trade tests to date have been sensational. Check these facts and write us today.

★ Does the work of a heavy-duty torch . . . but you should see how LIGHT it is—and easy to handle!

Cuts anything from tomato cans to 14" steel (using proper tips). Yet it's light-weight and perfectly balanced. A brute for performance but easy on the operator. We put into this torch what you and other operators asked for.

★ Slip-In-Tips—no wrenches needed.

Just slip the tip in, spin the nut with your fingers and you're ready to go. How could anything be easier? Try it yourself and see.

★ 3 interchangeable controls—quick change from one to the other in less than 1 minute.

1. Over lever. 2. Trigger. 3. Under lever as shown above.

No matter what type of cutting jet control you prefer, you have it in this torch—and you can switch from one to the other any time you want. Adaptable to any personal likes or techniques. Reduces number of torches needed to accommodate all operators' requirements.

★ No slag . . . cuts clean.

The new Smith Tips with this torch give you clean, knife-line cuts with narrow kerf and almost complete absence of slag. Operator does not have to waste time cleaning up his cuts. Speeds up production. Want a demonstration?

Write today for complete details

SMITH WELDING EQUIPMENT CORPORATION

Manufacturers of fine Welding Equipment for over 40 Years

SMITH WELDING EQUIPMENT CORP.
Dept. WE162 2633 S. E. 4th St., Minneapolis, Minn.

Please send me more information on the time-saving and money-saving features of your new torch.

Name_____

Address_____

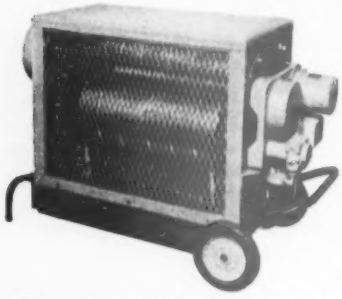
City_____ State_____

ON THE JOB

indoors or out

Any place—indoors or out—wherever clean, safe, dependable heat is needed on the job in a hurry . . . you can count on Silent Glow Portable Heat. Ideal for warming the men . . . heating the work area . . . temporary or emergency heat at all times.

INSTANT PORTABLE HEAT
WHEREVER . . . WHENEVER NEEDED



8 **MODELS**—*A Portable Heater to meet every heating need . . . radiant or forced air . . . from 168,000 to 420,000 BTU per hour. Write for details today.*

SILENT GLOW
Portable
RADIANT HEAT
BUILT TO DELIVER
BUILT TO TAKE IT

THE SILENT GLOW OIL BURNER CORP.
855 WINDSOR STREET, HARTFORD 1, CONNECTICUT

Engineering

ENGINEERING ANALYSIS. By D. W. Ver Planck and B. R. Teare, Jr. Published by John Wiley & Sons, Inc., New York, 1954. Cloth, 6 by 9 in., 344 pages. Price $6.

In *Engineering Analysis* the authors present an application of the case method to teaching the philosophy and methods of engineering analysis. They show what must be done to translate engineering situations into mathematical terms and what is necessary after a mathematical result has been obtained. More specifically, the book deals with such matters as: defining the problem to be solved; deciding what principle to apply; choosing coördinate systems; checking thoroughly; choosing dimensionless variables; the sketching of curves. These things, which constitute important elements of the professional method, are clearly presented in simple terms. This apparently is done in an effort to develop in the reader the broad patterns of thinking that are so important in day-to-day practice of engineering.

The book treats a number of subjects that engineers must truly understand and know how to use. The topics include material from dynamics of translation and rotation, electric circuits, heat transfer, solution of linear differential equations with constant coefficients, uses of power series, integration by graphical and numerical methods, hyperbolic functions and the evaluation of indeterminate forms.

To stimulate thinking, the book features an extensive collection of problems, with no clues given to methods of solution. As nearly as practical, the problems represent actual engineering situations. Thus they give the reader an opportunity to experience what the book aims to teach.

Titanium plant to be built by Electro Metallurgical

AT least 7,500 tons of titanium metal will be produced annually by a new plant to be built by Electro Metallurgical Co., a division of Union Carbide & Carbon Corp., New York City.

SAFE—NON-TOXIC . . .

"ANTI-BORAX"

"BRAZ-CAST"
No. 4 FLUX

for Bronze Welding Cast Iron

Produces finest results on Cast Iron without pre-heating or dismantling the casting. Low starting temperature—220°-250°.

ALSO

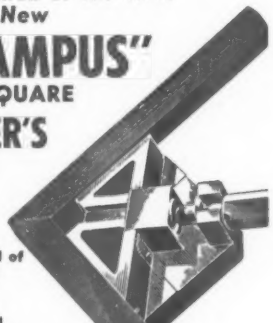
1—Cast Iron Welding Flux
2—Brazing Flux for Bress, Bronze, etc.
3—Brass, Bronze Welding Flux
5—Extra Quality Aluminum Flux
7—Steel Flux
8—Aluminum Flux
9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys, Dow Metal, etc.
16—Silver Solder Paste Flux

Save on Many Important Operations

The cost is so low for ANTI-BORAX Products compared with their importance that all weldors can profit by using them. All are **guaranteed—order by number.** Send for circular and **free sample.**

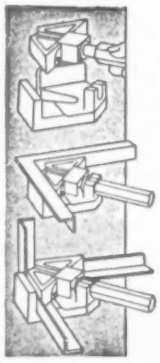
ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

Perfect
RIGHT-ANGLE WELDS
In a Fraction of the Time With the New
"GRAMPUS"
ALL SQUARE
WELDER'S VISE



A jump ahead of all holding fixtures

SPEEDY! ACCURATE! INEXPENSIVE!



Cuts down valuable time otherwise spent in setting mitred angle and other profiles, rounds and tubes for welding accurately at right angles. Work inserted is immediately ready for applying the seam and when released is free from distortion.
SPECIFICATIONS.
Model A. Profiles up to 2-in. or 1-in. diameter. Wt. 6 lbs.
Model 2A. Profiles up to 4-in. or 2-in diameter. Wt. 12 lbs.

BELMONT ABRASIVES
285 Newbury Street
BOSTON 15, MASS.

C. E. ADAMS has rejoined Adams Hard-Facing Co., Guymon and Wakita, Okla. He is vice-president and a director. His brother, MYRON ADAMS, is now sales manager of the firm.

* * *

PHILIP O. GEIER, JR., has been named sales manager of the Cincinnati Milling Products Division, Cincinnati Milling & Grinding Machines, Inc. He will be responsible for the sale of "Cimcool" cutting fluids and "Positive Duplication" grinding wheels, the two principal products of the division. Mr. Geier has been with the firm for more than 15 years, the last three and a half years with the division.

* * *

ROBERT J. HIRSCH has been appointed district sales manager for The Lincoln Electric Co., Cleveland, in its North Haven, Conn., office. He succeeds RICHARD P. LINDGREN, who has been named district manager in Moline, Ill. Mr. Hirsch will be responsible for sales throughout Connecticut. He formerly was in the firm's Pittsburgh district. Mr. Lindgren will be in charge of sales in northwestern Illinois and eastern Iowa. He has been with Lincoln since 1947.

* * *

GEORGE M. GILMORE is now eastern representative of Contour Marker Corp., Compton, Calif.

* * *

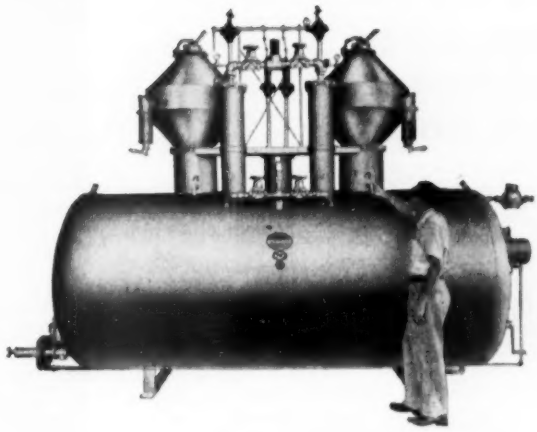
HARRY BUEGELEISEN, for 30 years associated with the goggle industry, is now representing Glendale Optical Co. east of Indianapolis, Ind.

* * *

ROBERT LEE WEIDMAN has been appointed technical sales representative in the Mid-Atlantic states for Cooper Alloy Corp., formerly known as The Cooper Alloy Foundry Co., Hillside, N. J.

designed for

modern acetylene production



Sight Feed

MODEL A-TWIN GENERATOR

for pipe-line distribution

If you're modernizing present shop facilities or enlarging acetylene production, investigate the Model A-Twin Generator. When requirements demand, acetylene can be produced continuously, without necessity of shut-down during recharging. Operation is safe and virtually automatic, requiring a minimum of attention and maintenance. No tank purging... No waste of acetylene.

Your welding supply distributor will be glad to discuss the economy and convenience of the Model A-Twin with you. Ask him for literature and our print No. 210-10-A, suggesting arrangement of a Model A-Twin and pipe-line system in your plant. If unavailable locally, write or phone

WELDING Sight Feed EQUIPMENT

THE SIGHT FEED GENERATOR CO.

55 East Third St.

WEST ALEXANDRIA, OHIO, U.S.A.

OBSOLETES ALL OTHERS

JUST LIKE THE NEW
cam-lok
"QUICK-DISCONNECT"
ELECTRODE HOLDERS

Here are the first really new electrode holders designed with the convenience of the welder in mind.

CHECK THESE FEATURES:

- ★ Eliminates need for carrying whips.
- ★ Plugs in quickly and easily to any cable end by merely adding standard Cam-Lok female connecters to cables. No adaptors required.
- ★ Less money tied up in cables.
- ★ No electrician and no tools required to change holders.
- ★ Complete holder body insulated with tough, heat resistant fibre glass.
- ★ High pressure positive lock – perfect conductivity.
- ★ Offset jaws permit infinite variety of electrode positions without rod-bending.
- ★ Offset holder keeps welder's hands farther from arc.
- ★ Offset holder permits burning rods to shorter stubs. Result—substantial savings.
- ★ Lightweight, insulated, rugged construction.
- ★ Choice of offset or straight jaws.

Send TODAY for Bulletin No. 121 giving full details on the new Cam-Lok "Quick-Disconnect" Electrode Holders!

cam-lok

DIVISION OF EMPIRE PRODUCTS, INC.
P. O. BOX M-98, CINCINNATI 36, OHIO

See us in Booth No. 1036 at the National Metal Exposition, Chicago

WESLEY S. THURSTON has joined the advertising and promotion staff of the Copper & Brass Association, New York City.

* * *

GEORGE R. PEASE has been named to head the welding section at The International Nickel Co.'s Bayonne, N. J., research laboratory. Since joining the laboratory in 1945, his work has centered on development of new welding electrodes and has resulted in a number of patents and technical papers. He is a member of the American Welding Society. Appointed at the same time were CLARENCE G. BIEBER, to head the special alloys section, and W. W. SELLERS to head the electrochemical section.

Pease

* * *

Norton Co., Worcester, Mass., recently announced the following changes in its outside sales force: CHARLES M. WELLONS has been named abrasive engineer for the Philadelphia territory, succeeding the late A. WATSON GOUGH; ROBERT C. DIVOLL has been appointed abrasive engineer for part of the Pittsburgh territory; CHARLES R. GARFIELD has been named a field engineer in the Pittsburgh district office; WILLIAM J. MAHAN has been made field engineer for abrasive grain applications in New England (except for Connecticut) and upper New York State; JOSEPH F. HARTL has been appointed sales engineer, abrasive grain, for Connecticut.

* * *

EDWARD R. ANDERSON has been elected a vice-president of American Brake Shoe Co., New York City. He continues as president of the firm's Am-Forge Division and will remain at the Chicago office.

* * *

JAMES T. KARABASZ has been named general manager of Luria Steel Supply Co., Inc., Bethlehem, Pa. He formerly was a regional sales representative for Joseph T. Ryerson & Son, Inc.

* * *

WILLIAM E. HORST recently joined Foote Mineral Co.'s research and development department, Philadelphia, as a metallurgical engineer.

"Red Head"
WELDING CLAMPS

- Designed for Welding
- No Threads To Damage

1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1968 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

For Permanent Good Results in Welding

METAL BOND
SOLDERING AND WELDING
PRODUCTS

- TINNING COMPOUND—cleans and tins in one operation
- SOLDERING SALTS—takes place of acids—fast cleaner
- HARD METAL—for scored cylinders and cast iron soldering
- ALUMINUM SOLDER—for cast or drawn aluminum and die-cast metal
- MOULDOUGH—for backing up job to weld against
- BRAZING FLUX NO. 10—for brazing all metals
- SPECIAL NO. 31—cast iron brazing flux
- SEAL-X-O—for filling pin holes in electric welds
- CAST IRON WELDING FLUX NO. 4—also All Steel Wire Brushes and Rod Holders

Try them yourself—find out why they are so widely used. Our handy-size catalog will give you helpful advice—send for it!

METAL BOND MFG. CO.
3201 KOSSUTH AVE.
ST. LOUIS 7, MISSOURI

GEORGE C. BLEW has been promoted to Kansas City, Mo., representative for Chelsea Fan & Blower Co., Inc., Plainfield, N. J. He formerly was service manager at the home office. His territory includes Kansas, Nebraska, Oklahoma, northern Texas, western Missouri and Ft. Smith, Ark.

* * *

The National Bearing Division of American Brake Shoe Co. has announced the appointments of NORMAN BIRCH as vice-president in charge of operations, I. EUGENE COX as vice-president in charge of engineering and development and BERNARD ESAREY as works manager of the Meadville, Pa., plant. Messrs. Cox and Birch will be located at division headquarters in St. Louis.

* * *

ORRIN E. BARNUM, regional manager of U. S. Steel Corp.'s treasury department in Pittsburgh, has been appointed treasurer of U. S. Steel Supply Division, Chicago. He succeeds ARTHUR E. BAYLEY, who has resigned.

* * *

Establishment of four new sections in the Development and Research Division of The International Nickel Co., Inc., New York City, has resulted in the following personnel changes: H. V. BEASLY has been placed in charge of the new constructional alloy steels section; CLARENCE H. SAMPLE, in charge of the electroplating section; T. E. KIHLGREN, the "Inco" nickel alloys development section; DR. V. N. KRIVOBOK, the stainless-steel and heat-resistant alloys section. W. Z. FRIEND has succeeded F. L. LAQUE as head of the corrosion engineering section; Mr. LaQue was recently promoted to vice-president and manager of the Research Division. DR. T. P. MAY and H. T. PATERSON have been appointed technical manager and operational manager, respectively, of the Kure Beach corrosion testing station near Wilmington, N. C. W. H. SPARR, JR., has succeeded Mr. Beasly in charge of the technical field section in Pittsburgh.

* * *

H. DOUGLASS MOULTON has been elected president of United States Steel Homes, Inc., U. S. Steel Corp. He succeeds GENERAL JOHN J. O'BRIEN, who resigned.

* * *

JULES F. FRITTS has joined the Mercer-Robinson Co., Inc., New York City, as executive vice-president. He formerly was works manager of Philadelphia Gear Works, Philadelphia.

NOW!!!
CESIUM RADIOGRAPHY SOURCES

33-Year Half Life... Very Low Cost... Increased Contrast... Lighter and Less Expensive Containers

Tracerlab has reduced prices of its Cesium-137 sources up to 70%, because the AEC has reduced its cost, we are now buying in quantity, and are encapsulating popular sized sources for stock. Cesium is being increasingly used for radiography because of its lower energy radiation (0.60 MEV), which makes it ideal for thin steel sections and less dense metals such as aluminum, because better contrast is obtained. Additional advantages are its long life and the use of lighter shipping containers. 1 Curie source (3/16" x 1/8" active dimensions) only $275.00.

Complete cost and delivery information on request.

Tracerlab

"WE CUT REWORKS 94% with DryRod Electrode Oven!"

When 1 out of 3 welded hydraulic fittings were rejected at a leading Milwaukee machinery plant*, engineers blamed *moist electrodes.* Installing a low-cost DryRod Electrode Oven to store all unpackaged low-hydrogen rods, this company got *immediate* improvement . . . faster, better welds . . . few rejects. Their welding engineer said, *"DryRod successfully solved our welding porosity problem. With it we've been able to cut our reworks from 30 pieces to less than 2 per hundred!"*

Get your money's worth

You pay a premium for stainless steel, low-hydrogen, and other mineral-coated electrodes. Preserve that "baked-in" quality with DryRod Electrode Oven. Ask your welding supply dealer, or write direct for free folder.

*Name on request

X-DR-12

Cut costs 4 ways with DryRod Method!

1 Store sealed cartons in warm, dry place.

3 Locate DryRod as close to welding operations as possible.

2 Place unpackaged electrodes in DryRod Oven and withdraw as needed.

4 For flexible, large-volume storage, stack ovens with compact DryRod Stands.

DryRod DIVISION OF Phoenix Products Co. 4715 N. 27TH ST. MILWAUKEE 16, WIS.

FREE BUYERS' GUIDE

Write Wire Phone For Your Copy

Packed with Information on:

A-S Torch Welding and Brazing Alloys

24 pages of purchasing data on 39 alloys and complete range of fluxes. Bare and flux-coated rods.

A-S Arc Welding Alloys

Same catalog includes welding and cutting electrodes for ferrous and non-ferrous metals and complete range of alloy steels.

A-S Soldering & Tinning Alloys

Book also includes cast iron, stainless steel and aluminum solders for torch and soldering iron application and galvanizing and tinning compounds.

A-S Silver Solders

Exact information is included in this book enabling user to select the particular silver alloy to do the best job at the least cost. Special silvers to solve special problems.

• All current All-State products are covered, including those recently released. This book is a buyer's guide to the complete line.

A-S DISTRIBUTORS EVERYWHERE

ALL-STATE

WELDING ALLOYS CO. INC.

White Plains, N.Y.

GEORGE W. STAIGER has been appointed representative of Weldaloy Products Co., East Detroit, Mich., in Ohio and western Pennsylvania. His headquarters will be in Cleveland. He will offer the complete Weldaloy product line for resistance welding.

* * *

JOHN P. CALUWAERT has been appointed manager of Industrial Air Products of the South, New Orleans. He succeeds the late G. H. JEUDEVINE. Mr. Caluwaert was formerly assistant sales manager of the firm's Portland office. Before joining Industrial Air in 1944, he worked for Stoody Co., Jackson Products, J. E. Haseltine Co. and Smith Welding Equipment Co.

Caluwaert

* * *

MALCOLM C. AVIS has been elected vice-president of General Welding Works, Inc., succeeding J. C. NELSON, who has left the firm.

* * *

WILLIAM MORSE recently joined the sales force of The Burdett Oxygen Co., Cleveland. He is the son of E. J. MORSE, Burdett's vice-president.

* * *

Recently announced were the following five appointments in U. S. Steel Corp.'s Fundamental Research Laboratory, now located in Kearny, N. J.: ROBERT H. ABORN, former assistant director, has been named director; LAWRENCE S. DARKEN, BERNARD M. LARSEN, DONALD S. MILLER and REGINALD L. RICKETT, have been named assistant directors, respectively, of physical chemistry, metallurgical processes, physics and physical metallurgy.

* * *

WILLIAM L. WEST has been elected president of Torit Mfg. Co., St. Paul, succeeding EDWARD J. GIRK, who has returned to the office of vice-president and sales manager in order that he might devote his time to sales promotional activities. Other officers elected at the recent board meeting: LAWRENCE F. KOERING, treasurer; GEORGE A. HUNA, secretary.

* * *

W. E. MULLESTEIN has been appointed general manager of sales for Lukens Steel Co., Coatesville, Pa. He had been manager of field sales.

WELDERS!

HALLWELL TOOL

2300 lbs. in 8 seconds

fast action

WELDING CLAMPS

SAVE TIME • SAVE MONEY •

UNCONDITIONALLY GUARANTEED

Just 2 easy, fast actions give you wedge-lock holding pressures, depending on size, from 500 to 4000 lbs. in seconds.

1. Thrust handle forward.
2. Turn handle to desired pressure.

No other tools needed.

15 sizes and models

Better . . . Faster . . . Lower Cost

Write Dept. W.E.2 for supplier or representative nearest you.

fast action CLAMPS — HALLWELL TOOL COMPANY, 600 SOUTH HILL STREET, LOS ANGELES 14, CALIF.

ALJAY "Saf-T"

APRONS • BIBS
CAPES • CHAPS
COATS • GLOVES
PANTS • SLEEVES
OVERALLS • SPATS
CURTAINS

WELDERS CLOTHING

for COMFORT, SAFETY, WEAR

The BEST in Welders' protection. Made of finest chrome tanned leather specially treated for heat resistance. Cut full size. Riveted at strain-points. Double stitched. High quality, soft, pliable, made for long hard service.

Write for our CATALOG LISTINGS and low price list "N"

ALJAY MFG. CO. INC.

SPECIALISTS IN WELDERS CLOTHING

1518 CALLOWHILL ST., PHILA. 30, PA.

30 YEARS AGO

(Taken from THE WELDING ENGINEER *of November, 1924)*

THIS issue covers the fifth fall meeting of the American Welding Society, held in Cleveland, and the 25th convention of the International Acetylene Association, which met in Chicago.

—30 YEARS AGO—

A FAREWELL luncheon was given in Chicago in honor of C. T. Price, who resigned as secretary of the Gas Products Association. He has become vice-president and sales manager of Portland Oxygen-Hydrogen Co., Portland, Ore.

—30 YEARS AGO—

"CARBON Electrode Welding in Railroad Shops" is the title of an article appearing in this issue by Juan St. Cere, welding foreman, New York Central Railroad Co., Depew, N. Y.

—30 YEARS AGO—

IN addition to adding a new unit to its Chicago plant, Air Reduction Sales Co. has completed new plants at Birmingham, Ala.; Harrisburg, Pa.; and Seattle, Wash. It has also doubled the capacity of the Baltimore plant. This expansion program will be completed when the oxygen plant at Lima, O., is finished and three other plants remodeled.

—30 YEARS AGO—

THE Pittsburgh section of the American Welding Society was recently treated to a demonstration of a new system of arc welding and cutting by Andrew Smith, manager of Smith Metal Perforating Co. The system includes special welding panels designed to make possible more accurate control of the arc, a migratory arc and a non-consumable electrode.

—30 YEARS AGO—

THE welding industry's bright future was the topic of a talk given before the Chicago section of American Welding Society by W. A. Slack, of Torchweld Equipment Co., Chicago.

—30 YEARS AGO—

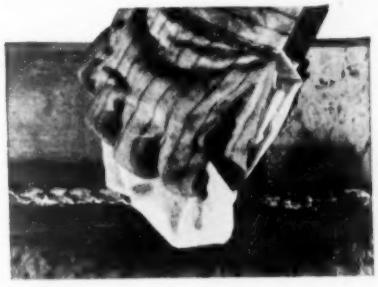
GIBB Instrument Co., Bay City, Mich., has appointed H. B. Beronious its representative in Iowa, Kansas, Nebraska, Oklahoma and Northwest Missouri.

—30 YEARS AGO—

ELECTRIC Welding Supply Sales Co., Boston, has recently been incorporated and will take over the business of the firm of the same name.

—30 YEARS AGO—

M. KEITH Dunham sailed on the *Leviathan* this month for a business trip to England and Germany.



cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time — P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke, odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic, water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.25 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of sub-assemblies. $3.30 per gallon, f.o.b. Dayton.

MONEY-BACK TRIAL OFFER

Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

PROTECT-O-METAL

G. W. SMITH & SONS, INC. 5408 KEMP ROAD, DAYTON, O.

RUEMELIN *Welding Fume Collectors*

Illustrating Ruemelin Fume Collectors in action. Part of a group of sixteen collectors at plant of Sterling Wheelbarrow Co., Milwaukee.

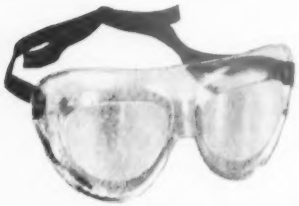
Collects fumes at the source! Counterbalanced inlet hood stays in working area automatically. Hoods have great lateral and vertical range for table, positioner or floor use. Thousands in every day service. Write for bulletin 37-E.

RUEMELIN MFG. CO.

MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT, 3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

sellstrom
safeguards
designed for comfort

"FETHERWATE" ONE-PIECE GOGGLES —The Year's Biggest Innovation



Never before in our 30 years of business have we offered a product which so instantly achieved popularity as did these goggles. Because of this experience engineers have been busy in an effort to further improve them. This resulted in finding a method which increased the clarity by eliminating the usual imperfections.

If you have a dust or similar hazard, these "Fetherwate" goggles will be welcomed by your employees. They render real service—have a long life—and the price is extremely low. Here are reasons for the popularity of these No. 30 Goggles.

1. Light weight. Less than ½ ounce. You barely realize that you have full eye protection.
2. Seeing clarity has been so improved that it now equals the clarity of the highest quality spectacle lenses. The seeing section is perfect—absolutely free from imperfections.
3. The special clear .020 acetate withstands flame and pitting.
4. The rounded lens wraps around the eyes, assuring the greatest possible comfort. Adjustable flat elastic headband.
5. Gives full protection to the eyes. Guards against dust and similar eye hazards.

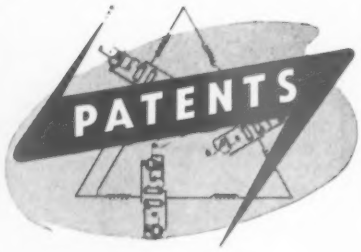
Most dealers carry these goggles in stock and can make immediate delivery. We suggest that you adopt them as standard equipment for employees.

If you have never used these goggles, we suggest that you write for a sample pair on memo for test purposes. If after 30 days trial you do not find them everything and more than we claim, return them for full credit.

sellstrom MANUFACTURING COMPANY

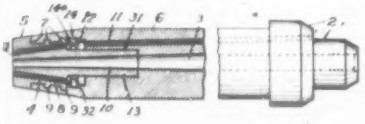
Eye and Face Safeguards Designed for Utmost Comfort

226 Hicks Road **Palatine, Ill.**



Torch tip

2,671,501. Daniel A. Marra, Cheswick, Pa. Filed April 28, 1948. Granted March 9, 1954.



This patent concerns a blowpipe tip, the tubular body of which is composed of a metal of relatively low strength and durability when exposed to steel at fusing temperature in the presence of oxygen. The tubular body has a delivery end with a terminal face, a sintered carbide shoe on such end that has a flanged head portion overlying the terminal face at the delivery end and a neck portion integrally embodied in the end. A ring-shaped chamber is formed between the latter portion and tip body. The body includes a passage leading to the chamber from which a number of bores lead through the portions of the shoe. These bores are inclined in direction of their extent from the chamber toward a point of poly-impingement spaced from the delivery end. This shoe is characterized by relatively great durability when exposed to steel at melting temperature in oxygen and in the assembled structure comprising a fracture-resistant guard for said body. A ring-shaped baffle extends inwardly from the tip body adjacent its delivery end.

* * *

A-C arc welder

2,671,843. Richard B. Steele, New Providence, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed June 7, 1950. Granted March 9, 1954.

This patent concerns an a-c arc welder. A welding circuit is connected to an electrode and to a workpiece for supplying alternating welding current to maintain the arc. Included is a means for adjusting welding position of the electrode in relation to the workpiece. Also provided is a means for actuating the adjusting means in order to maintain a constant arc length.

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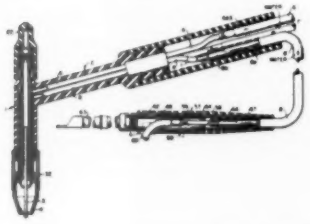
Gas-shielded welder

2,659,797. NELSON E. ANDERSON, Berkeley Heights, and EDMUND T. SULLIVAN, Laurence Harbor, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed March 1, 1951. Granted Nov. 17, 1953.

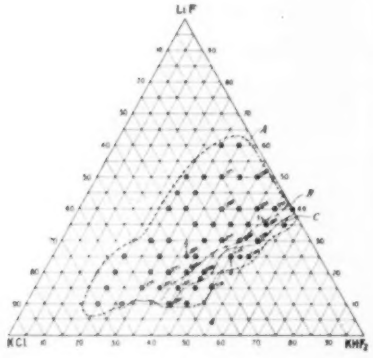


This patent concerns a gas-shielded arc welder that uses chemically clean, flexible aluminum electrode wire. A manual gun contains an inner-wire guide assembly, a surface of which is in contact with the wire. A contact for the welding current is closer to the welding arc than it is to the wire-guide assembly. Another assembly includes a shield and a conductor for the surrounding outer gas. A flexible casing of fixed length, which conveys the aluminum wire, is connected to the rear of the gun. This casing is lined with nylon, which is in contact with the wire. The wire is pushed through the casing and the gun's components by means of a power-driven feed mechanism.

* * *

Brazing flux

2,666,725. ERNEST S. CHAMER, Fairfield, Conn. Assigned to Handy & Harman, New York City. Filed Nov. 30, 1951. Granted Jan. 19, 1954.



A flux for use in silver-alloy brazing of titanium and related metals is covered by this patent. The flux consists essentially of LiF, KCl and KHF_2 present in the same weight proportions as in the compositions lying approximately within the area defined in the above drawing by line "A."

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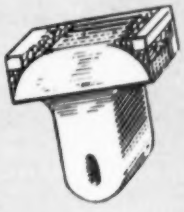

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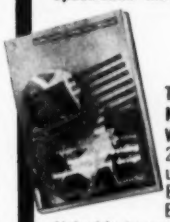

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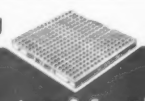

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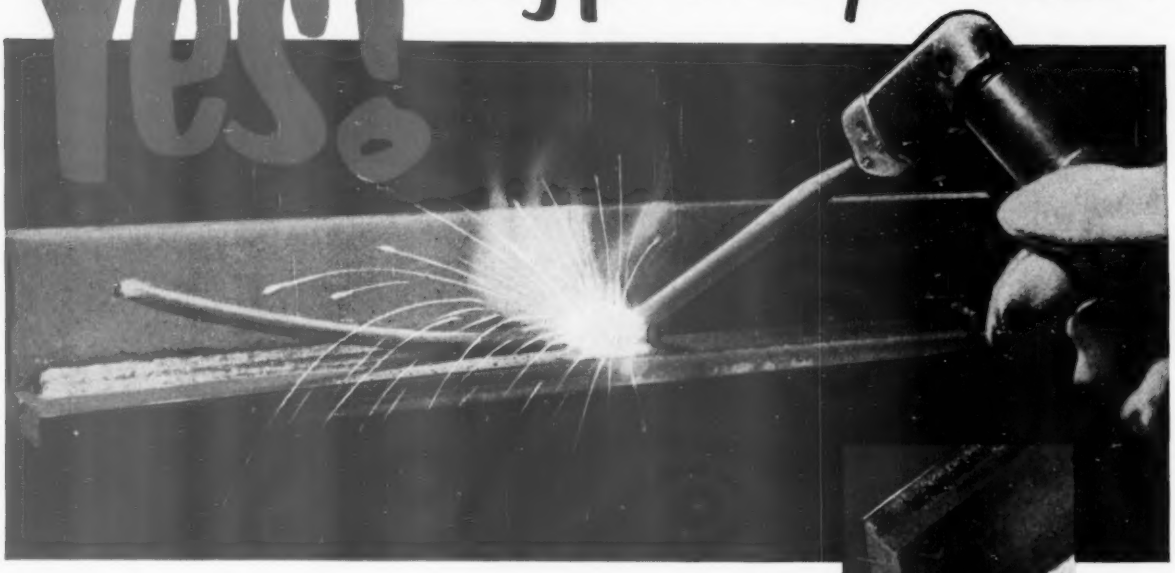

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